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Piening et al.

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(45) **Date of Patent: Apr. 5, 2016**

(54) **SYSTEM AND METHOD FOR ADJUSTING A PICK HEIGHT OF A PICK MECHANISM IN AN IMAGE FORMING DEVICE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) Filed: **Apr. 14, 2015**

(51) **Int. Cl.**

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B65H 1/18	(2006.01)
B65H 3/06	(2006.01)
B65H 7/02	(2006.01)
B65H 1/04	(2006.01)
B65H 7/20	(2006.01)

(52) **U.S. Cl.**
CPC .. ***B65H 1/14*** (2013.01); ***B65H 1/04*** (2013.01); ***B65H 1/18*** (2013.01); ***B65H 3/0684*** (2013.01); ***B65H 7/02*** (2013.01); ***B65H 7/20*** (2013.01)

(58) **Field of Classification Search**
CPC B65H 1/14; B65H 1/18; B65H 3/0684; B65H 7/02; B65H 7/20; B65H 7/14
See application file for complete search history.

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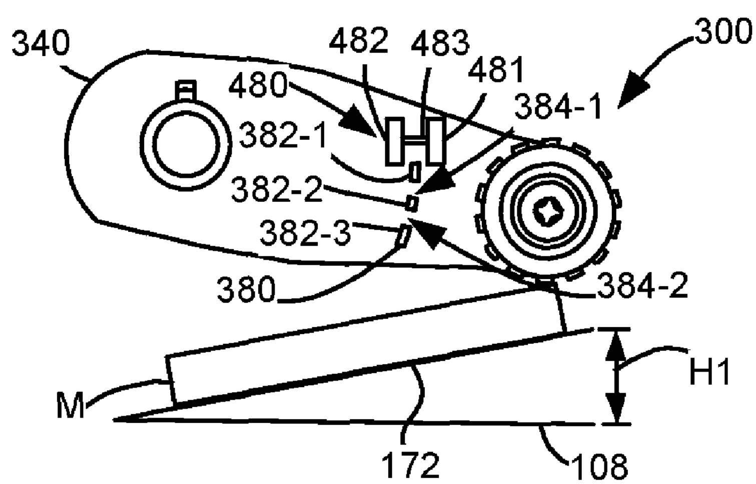
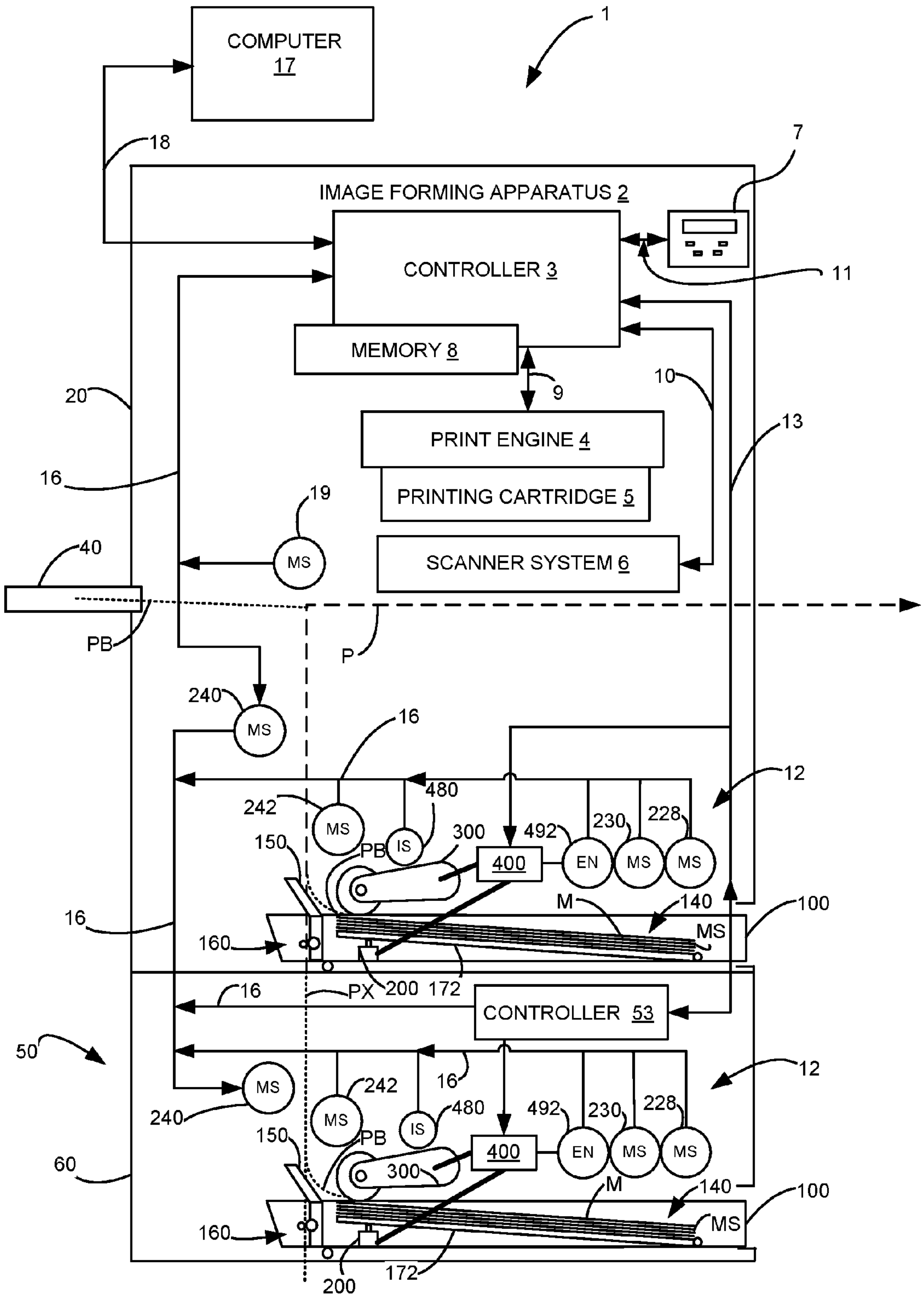
(74) *Attorney, Agent, or Firm* — John Victor Pezdek

(57) **ABSTRACT**

A method for adjusting a pick height of a pick mechanism includes determining a media type for a media stack. When the media type is a first media type, the lift plate is raised to raise the media stack and pick mechanism until a first light blocking region of a flag extending from the pick mechanism blocks an optical path of a sensor indicating that the pick mechanism has reached a first pick height. When the media type is a second media type, the lift plate is raised to raise the media stack and pick mechanism such that the first light blocking region first blocks the optical path, a first light passing region of the flag subsequently unblocks the optical path, and then a second light blocking region of the flag subsequently blocks the optical path indicating that the pick mechanism has reached a second pick height.

13 Claims, 18 Drawing Sheets

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CONTROLLER 3
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PRINT ENGINE 4
PRINTING CARTRIDGE 5
16
19
MS
SCANNER SYSTEM 6
40
PB
P
240
MS
16
12
480
242
MS
IS
300
492
230
228
150
PB
400
EN
MS
MS
M
140
100
16
MS
160
200
172
16
PX
CONTROLLER 53
50
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16
MS
242
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492
230
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172
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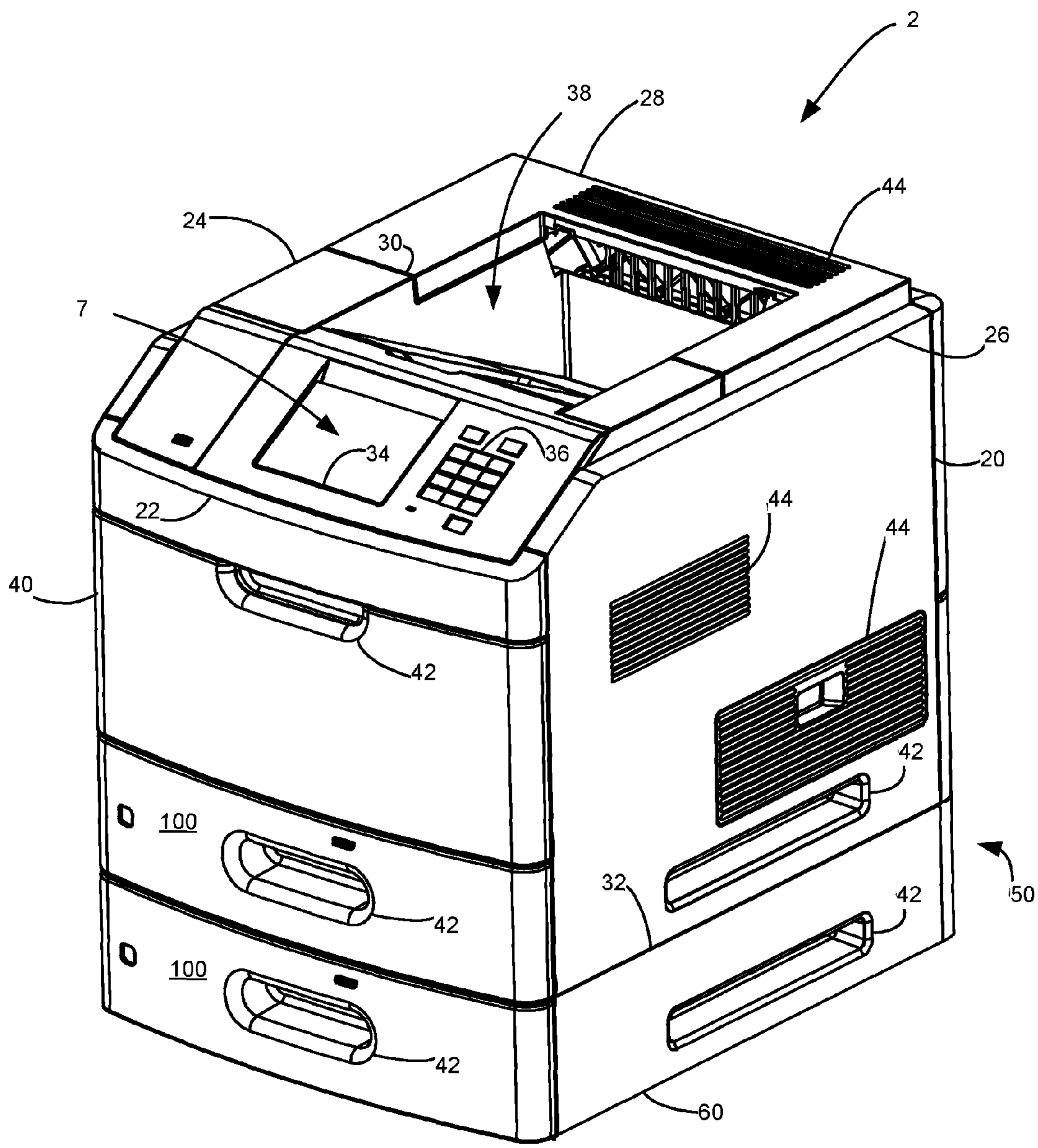
FIGURE 1


2
38
28
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24
30
7
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22
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42
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32
42
100
42
60

FIGURE 2

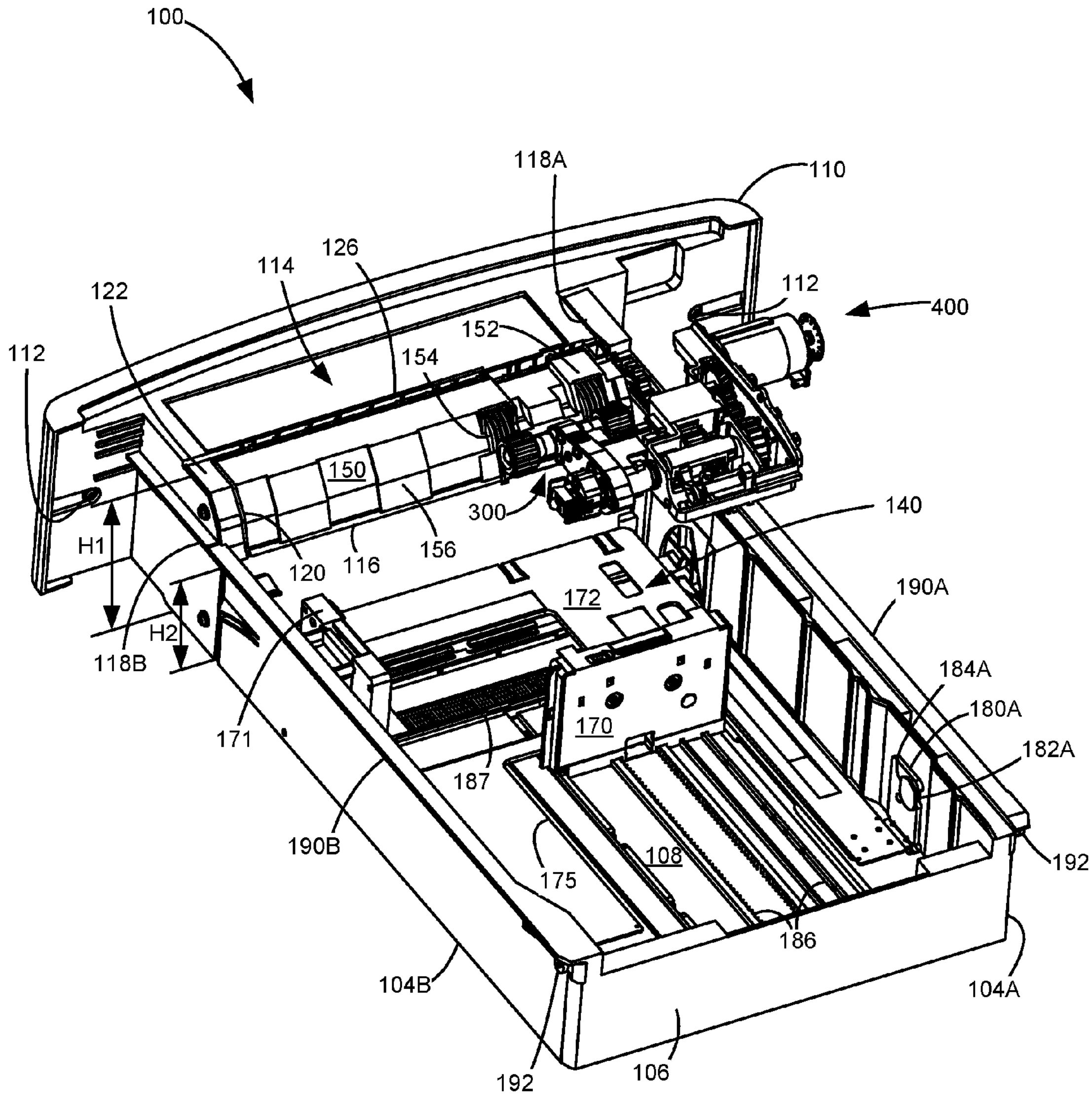

100
118A
110
126
114
112
400
122
152
154
112
150
300
140
H1
120
116
156
172
190A
H2
118B
184A
171
170
180A
182A
187
190B
108
192
175
186
104B
104A
192
106

FIGURE 3

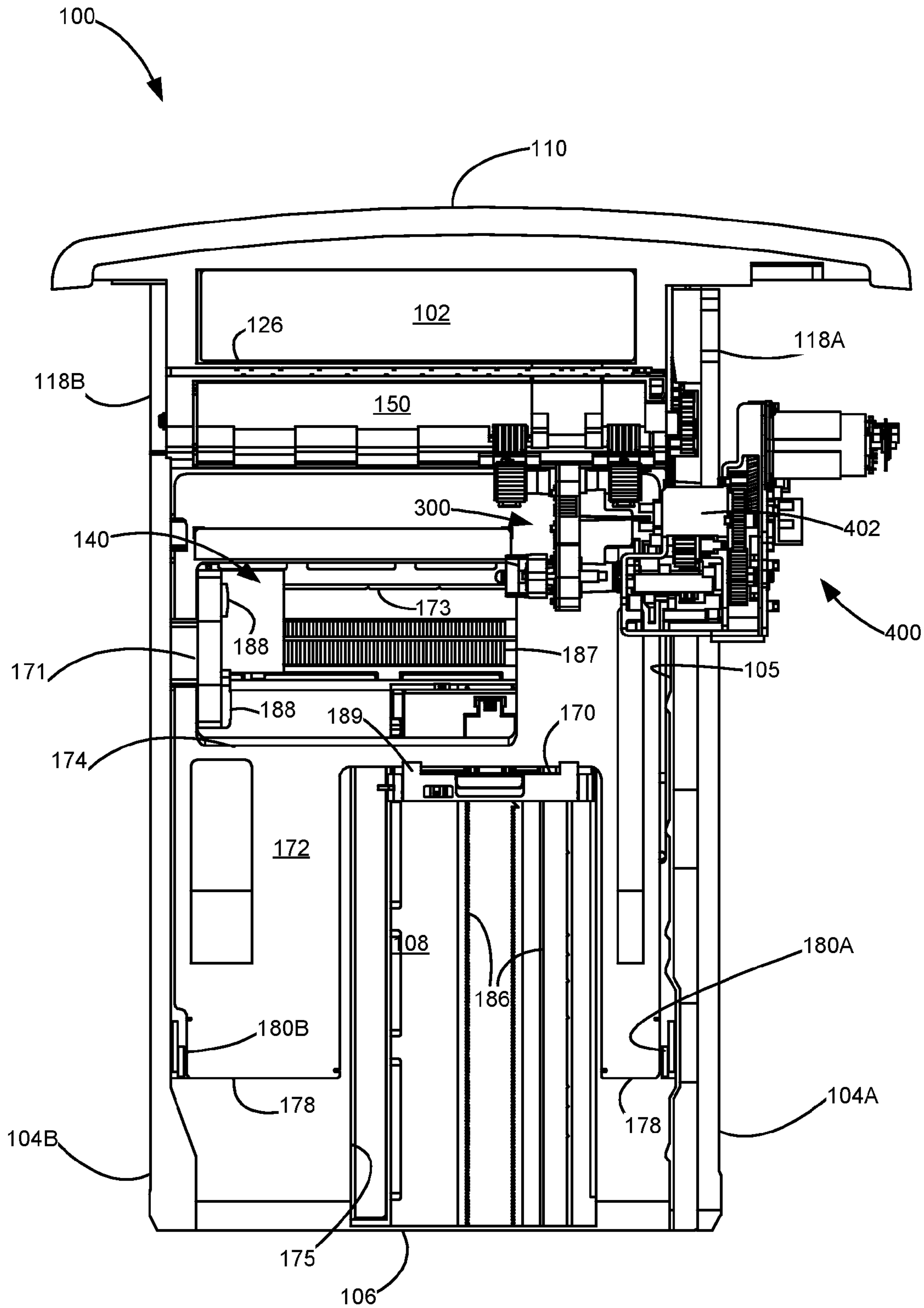

100
110
102
126
118A
118B
150
300
402
140
173
188
187
400
171
105
188
189
170
174
172
108
186
180A
180B
178
178
104A
104B
175
106

FIGURE 4

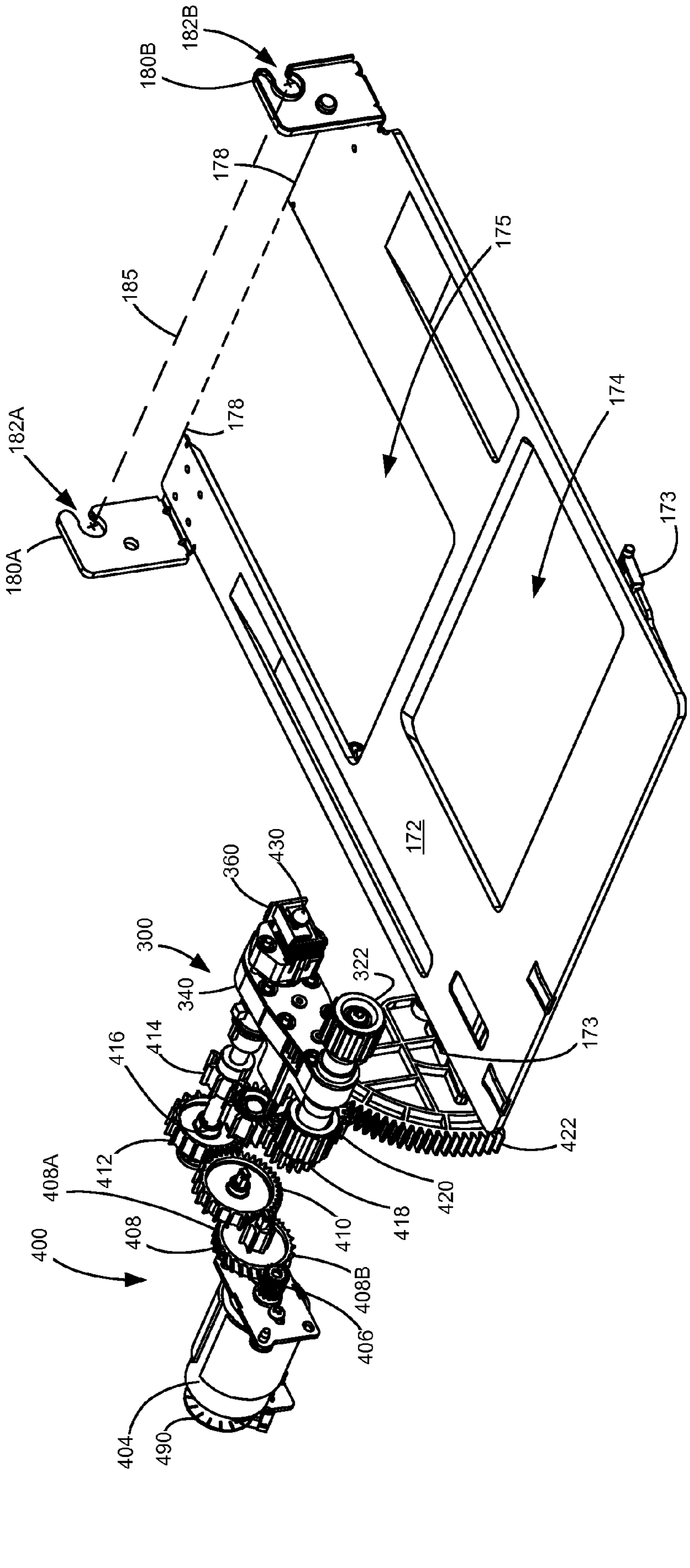

182B
180B
178
175
185
174
182A
178
180A
173
172
430
360
300
340
322
173
416
414
412
408A
408
400
410
418
420
422
408B
406
404
490

FIGURE 5

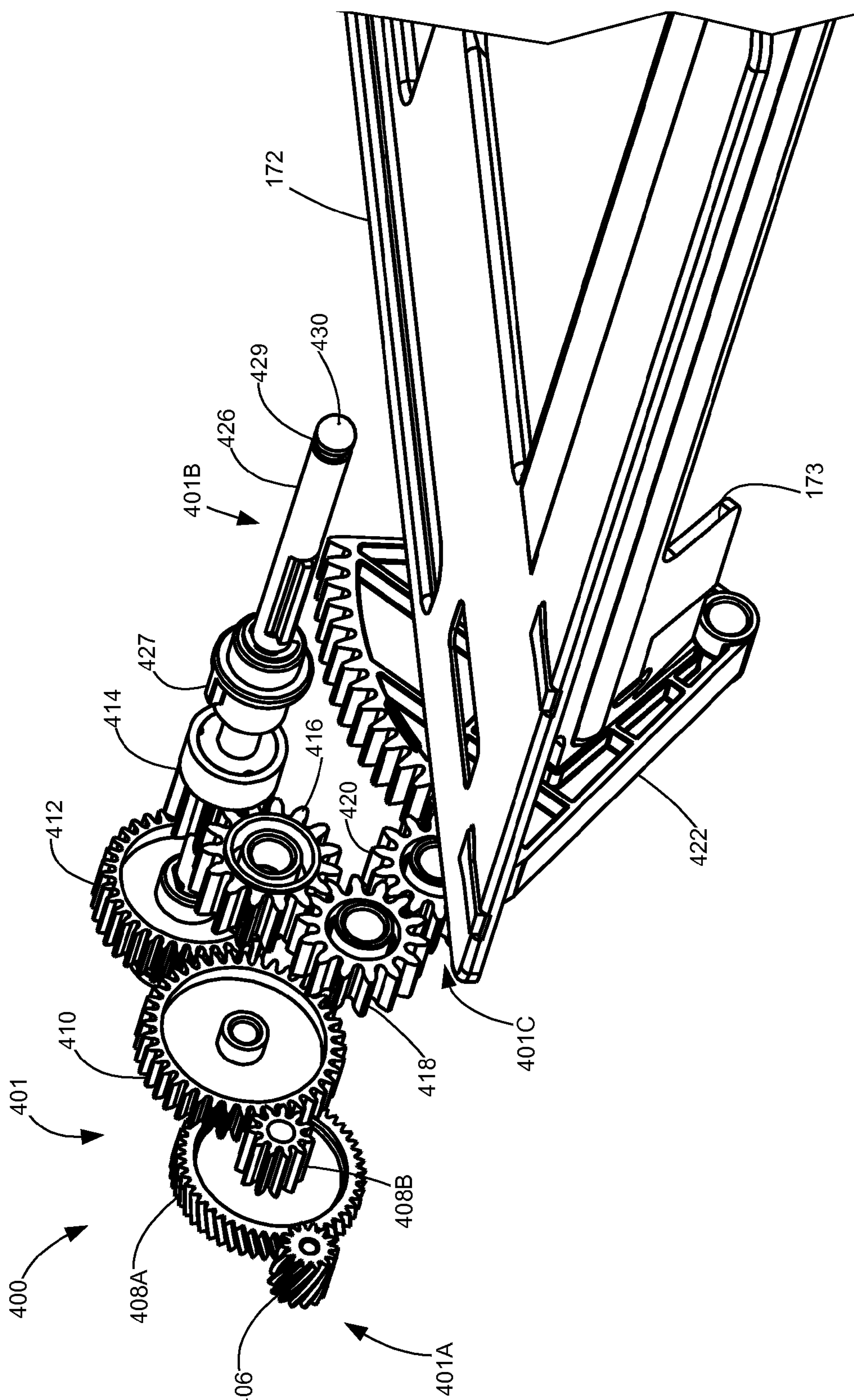

172
173
430
429
426
401B
427
414
416
412
420
422
410
418
401C
401
408B
400
408A
406
401A

FIGURE 6

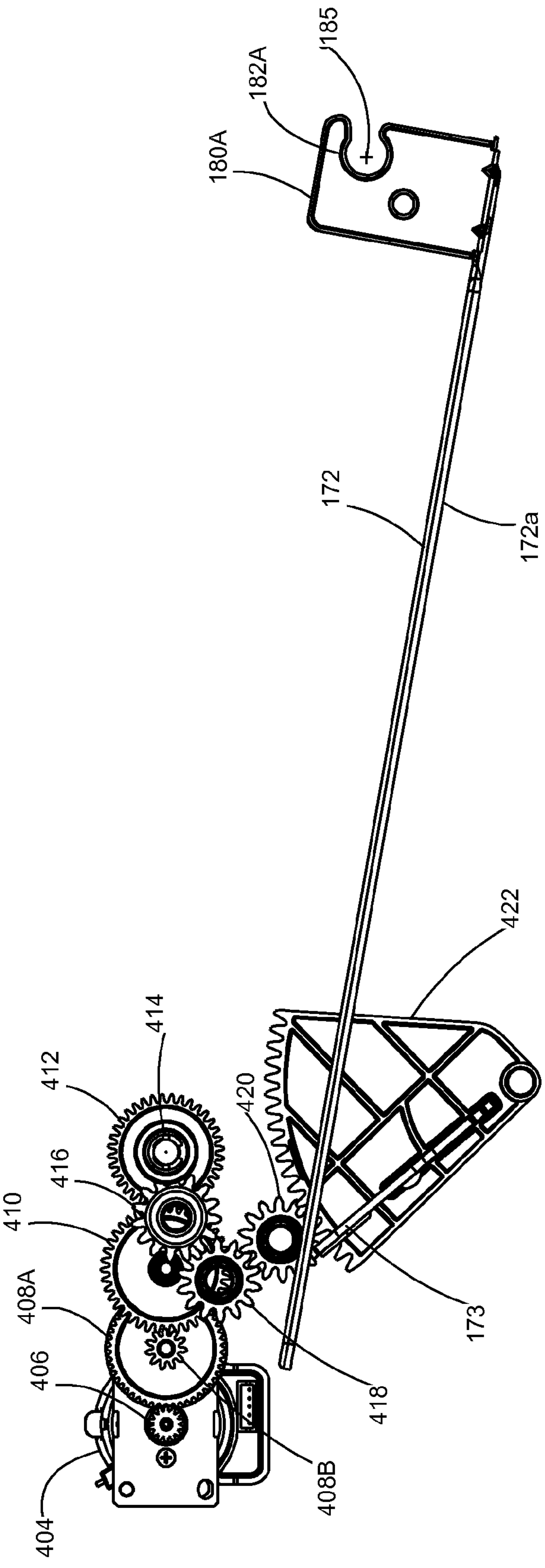

185
182A
180A
172
172a
422
414
412
420
416
410
408A
406
173
418
408B
404

FIGURE 7

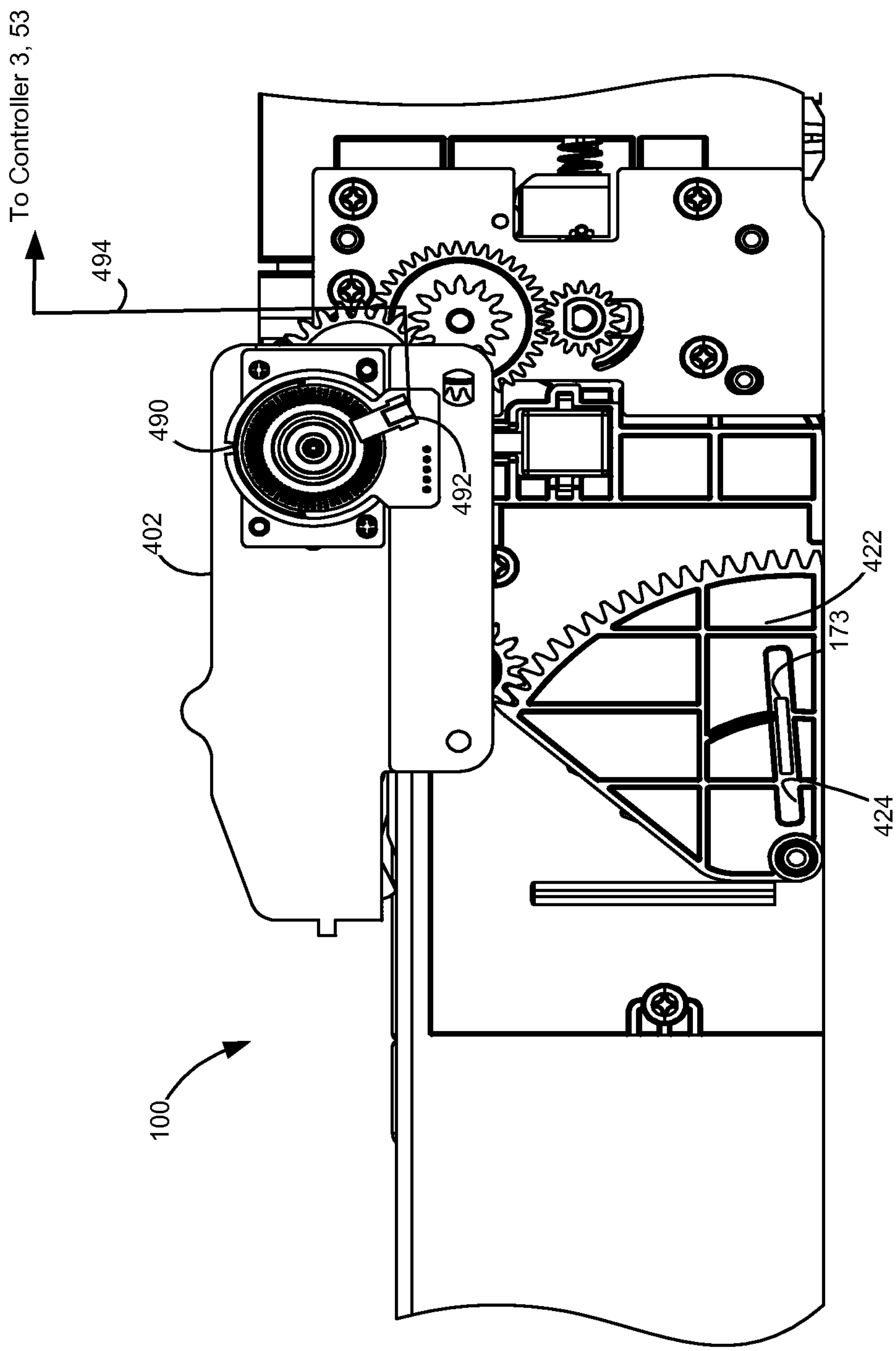


FIGURE 8

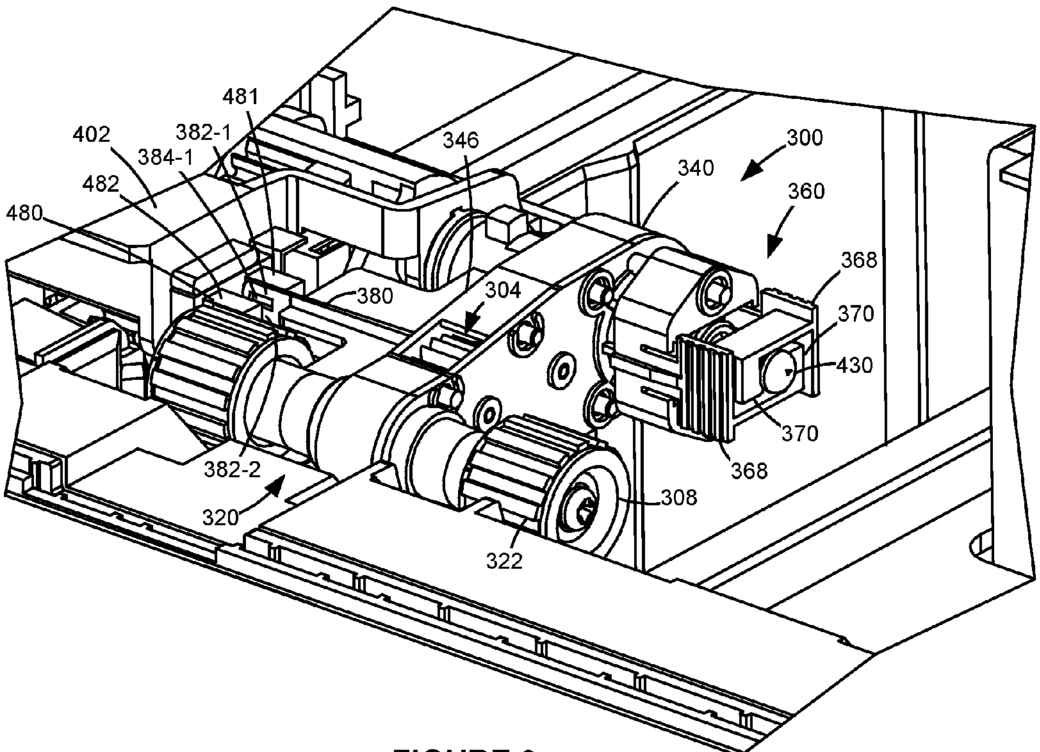


FIGURE 9

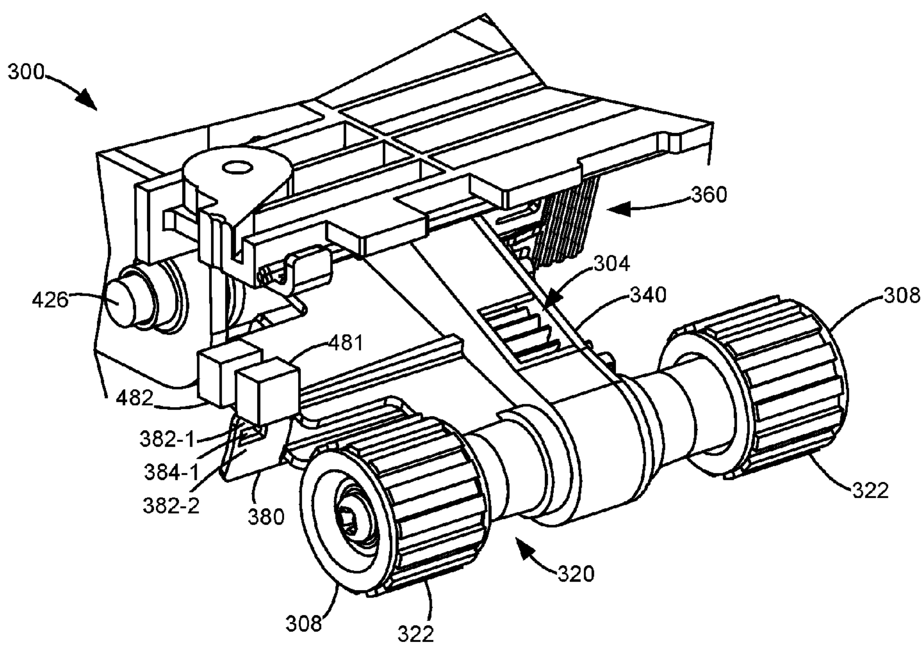


FIGURE 10

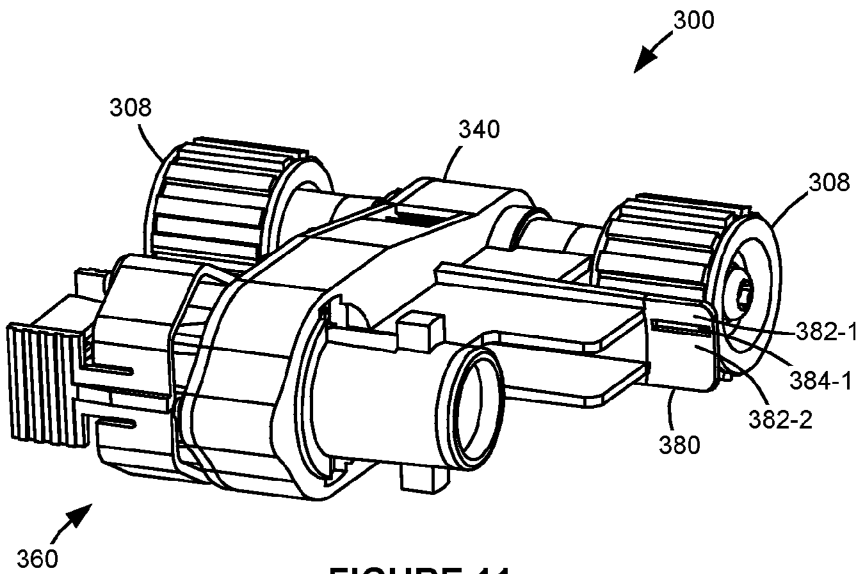


FIGURE 11

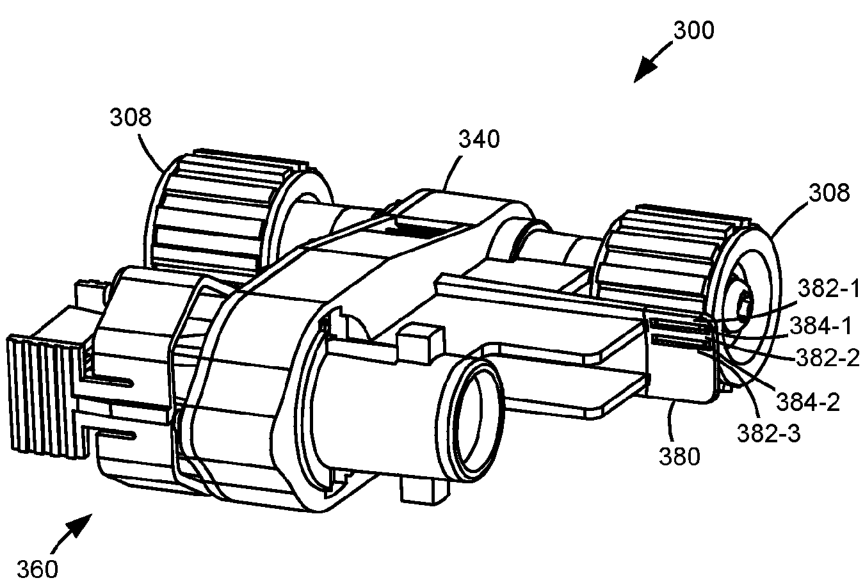


FIGURE 12

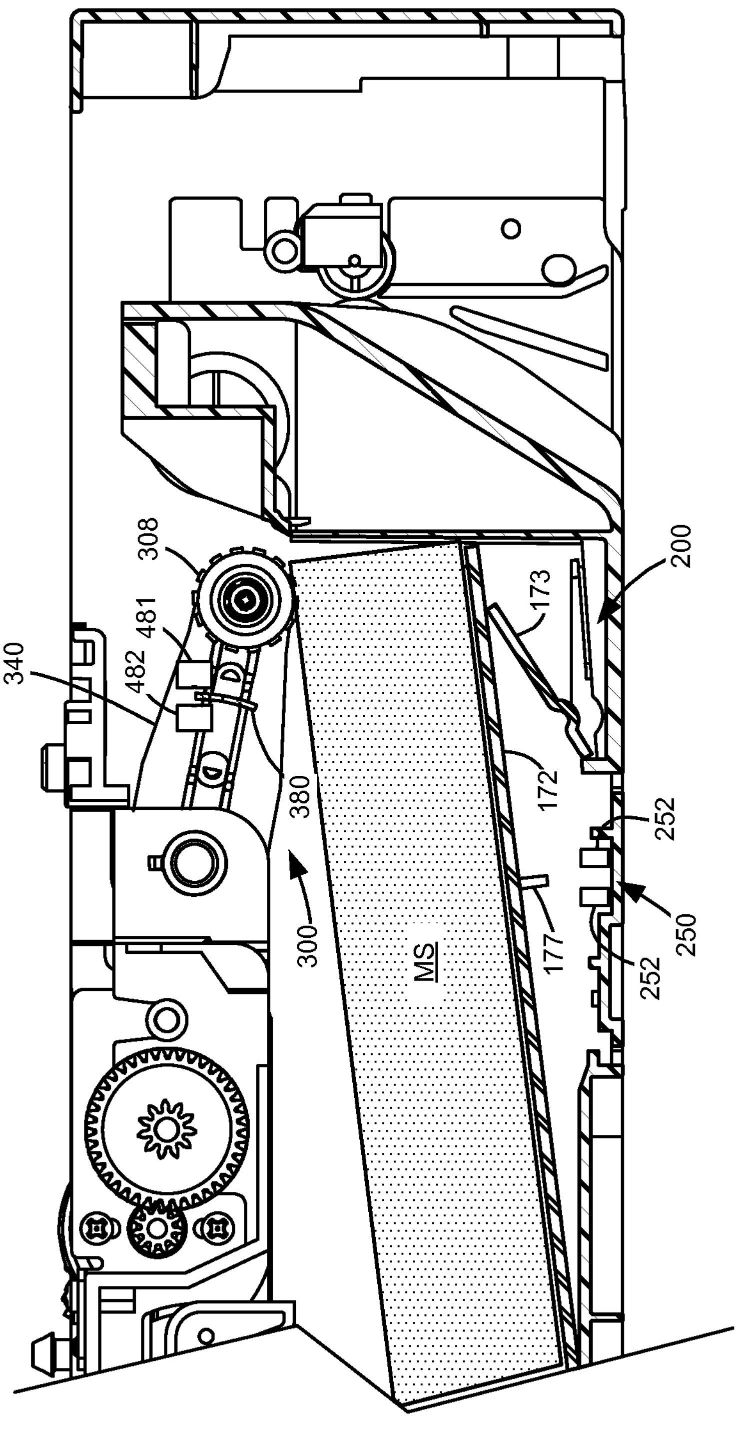


FIGURE 13

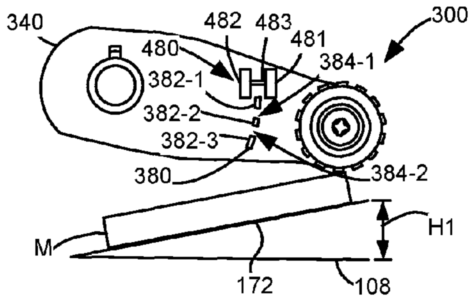


FIGURE 14A

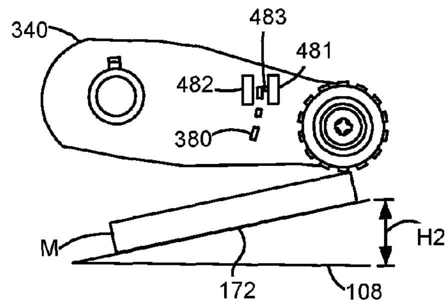


FIGURE 14B

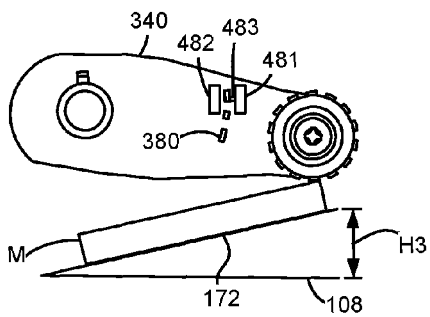


FIGURE 14C

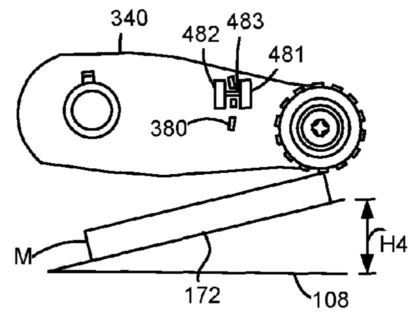


FIGURE 14D

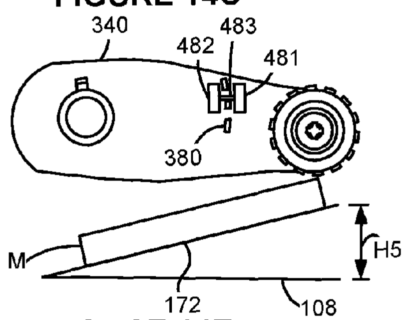
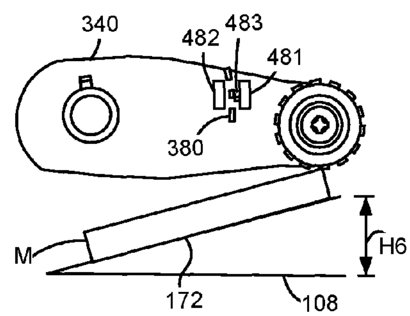


FIGURE 14E



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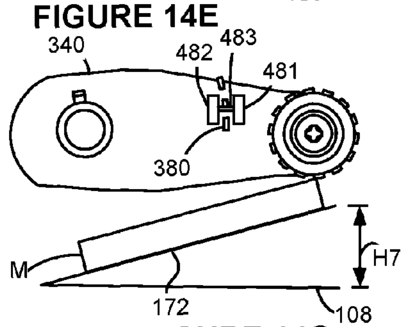

FIGURE 14G

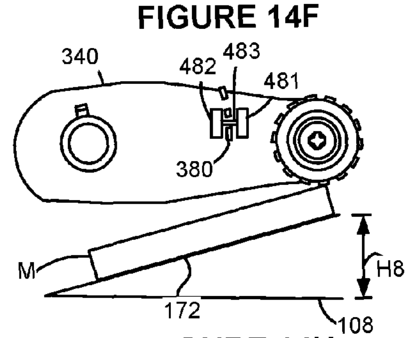

FIGURE 14H

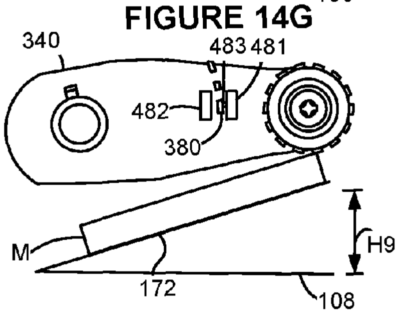

FIGURE 14I

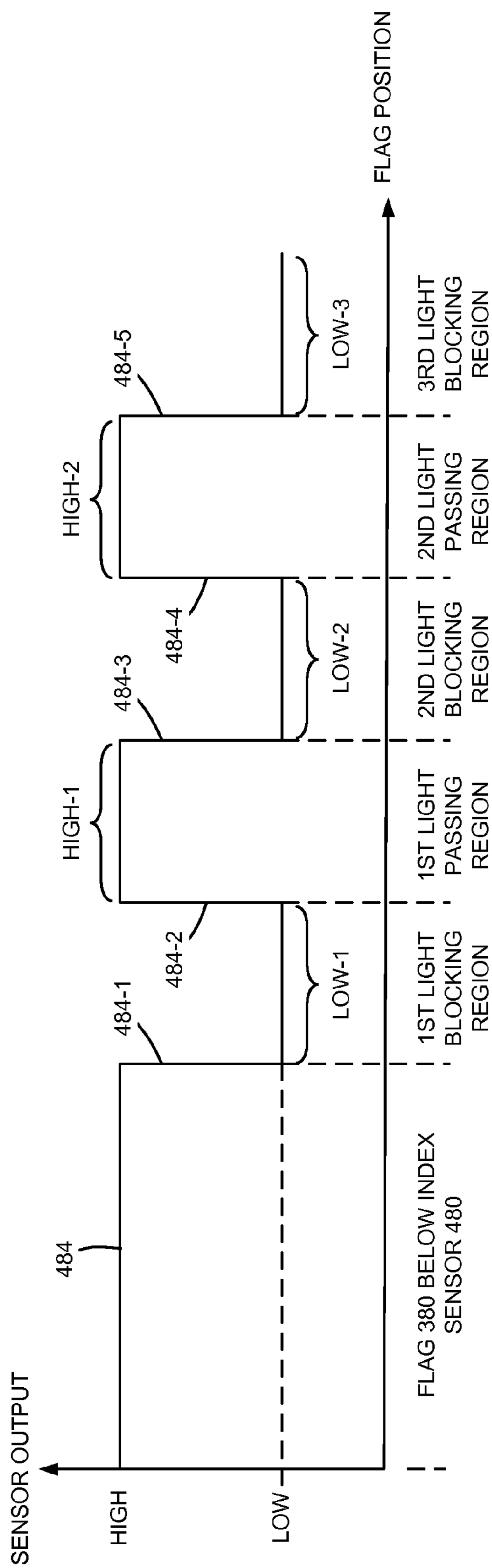
SENSOR OUTPUT
HIGH
LOW
FLAG POSITION
484
484-1
484-2
484-3
484-4
484-5
HIGH-1
HIGH-2
LOW-1
LOW-2
LOW-3
FLAG 380 BELOW INDEX SENSOR 480
1ST LIGHT BLOCKING REGION
1ST LIGHT PASSING REGION
2ND LIGHT BLOCKING REGION
2ND LIGHT PASSING REGION
3RD LIGHT BLOCKING REGION

FIGURE 15

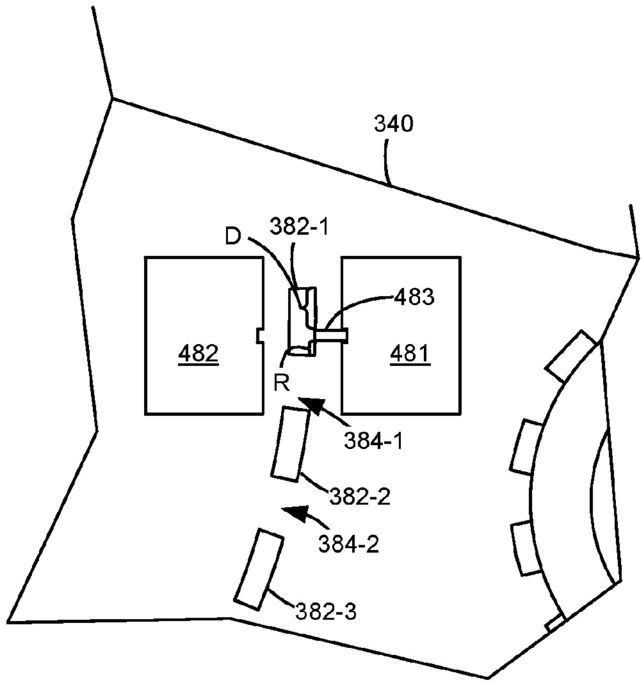

FIGURE 16

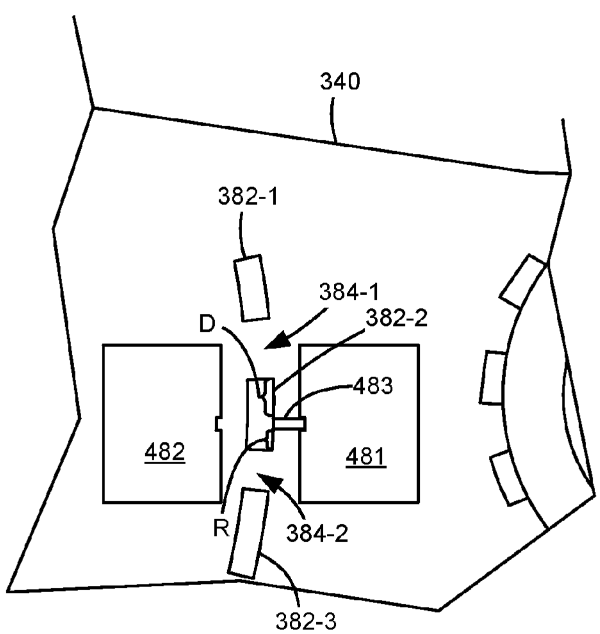

FIGURE 17

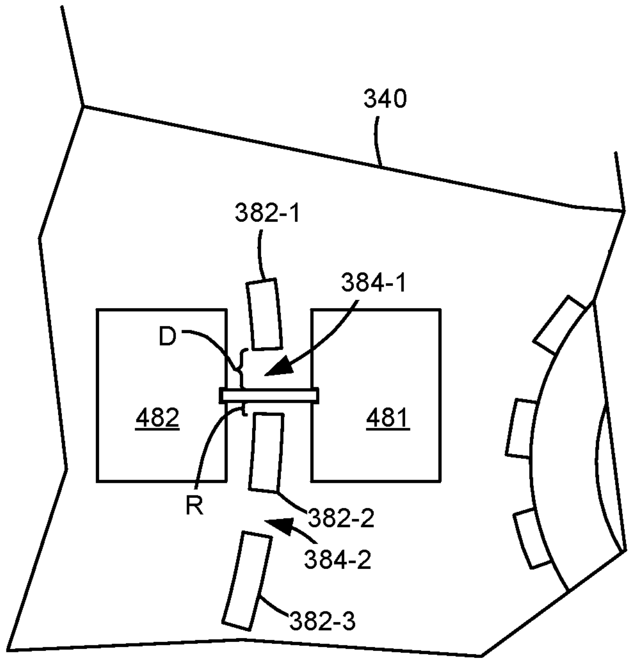

FIGURE 18

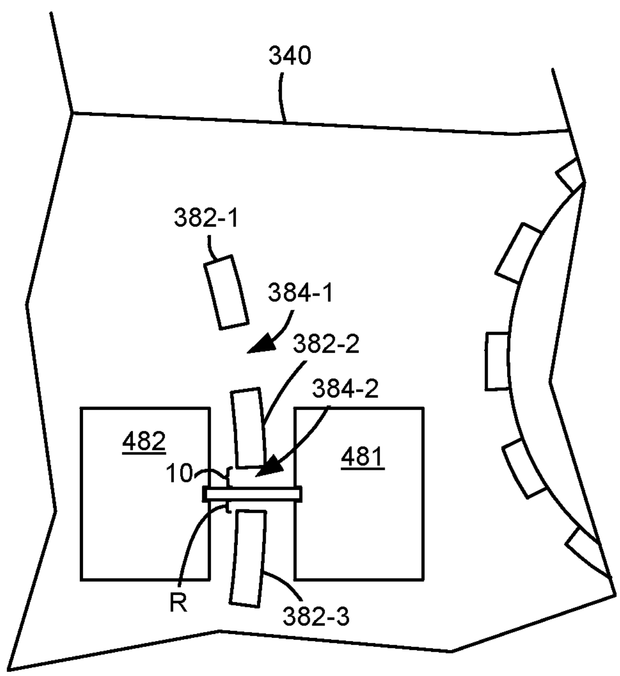

FIGURE 19

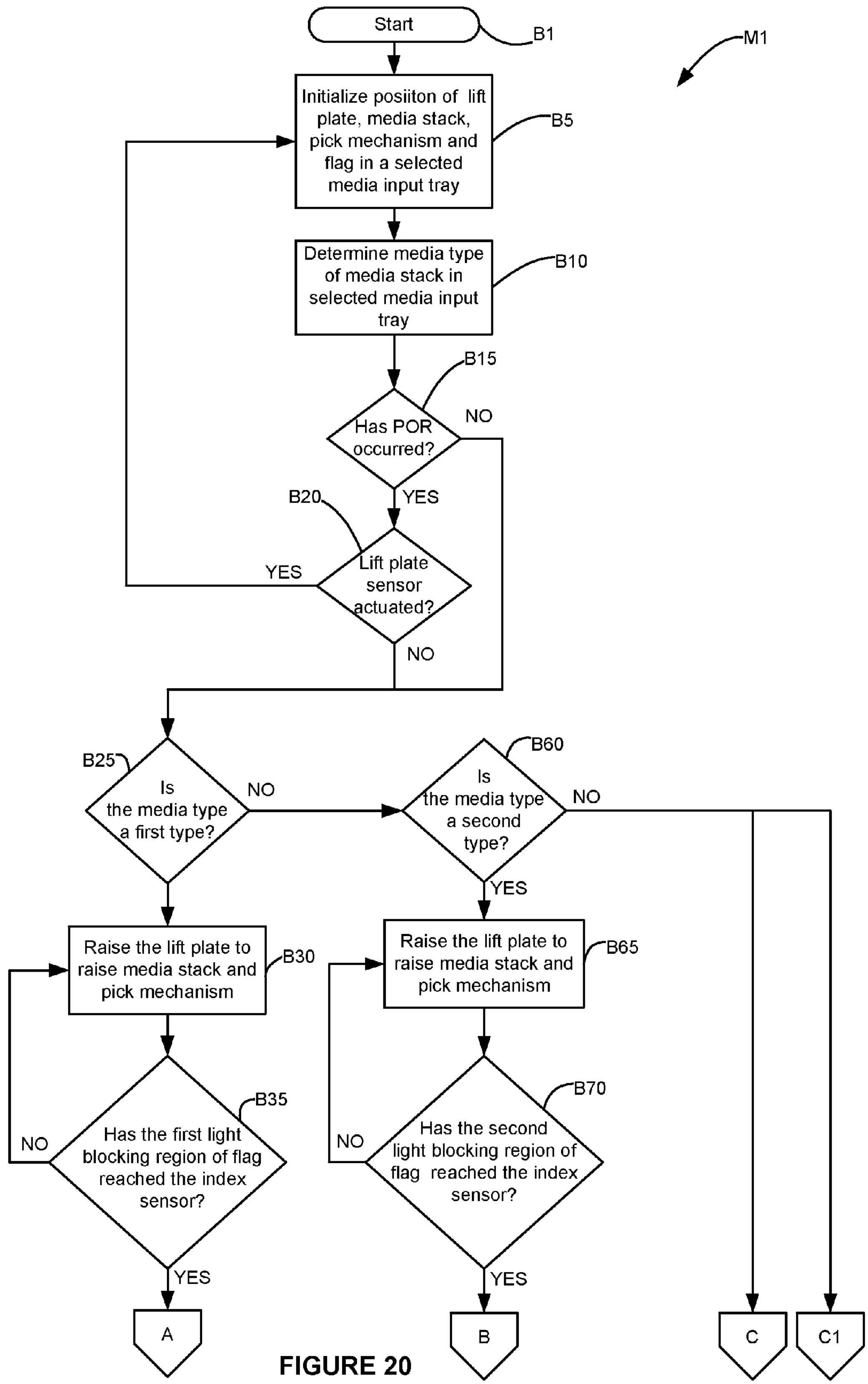
Start
B1
M1
Initialize posiiton of lift plate, media stack, pick mechanism and flag in a selected media input tray
B5
Determine media type of media stack in selected media input tray
B10
B15
Has POR occurred?
NO
YES
B20
Lift plate sensor actuated?
YES
NO
B25
Is the media type a first type?
NO
B60
Is the media type a second type?
NO
YES
Raise the lift plate to raise media stack and pick mechanism
B30
Raise the lift plate to raise media stack and pick mechanism
B65
B35
Has the first light blocking region of flag reached the index sensor?
NO
YES
B70
Has the second light blocking region of flag reached the index sensor?
NO
YES
A
B
C
C1

FIGURE 20

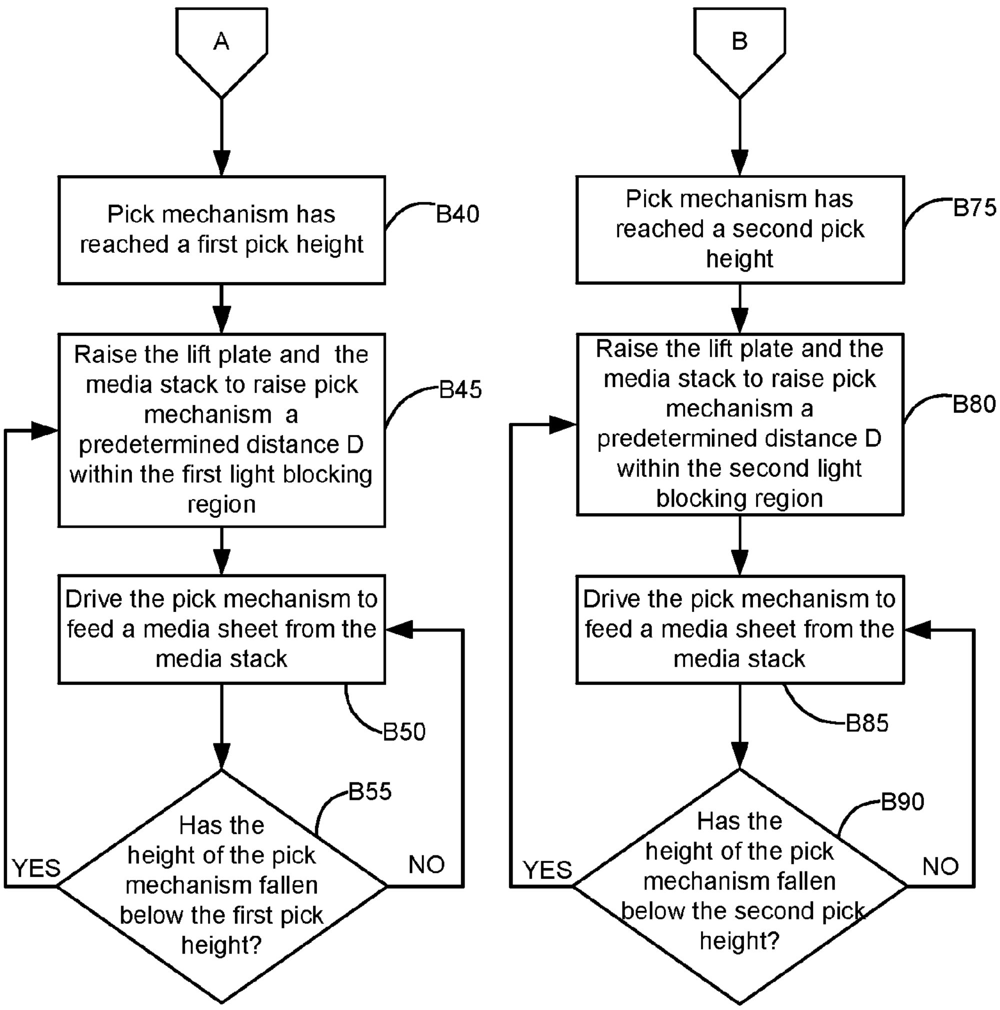
A
Pick mechanism has reached a first pick height
B40
Raise the lift plate and the media stack to raise pick mechanism a predetermined distance D within the first light blocking region
B45
Drive the pick mechanism to feed a media sheet from the media stack
B50
B55
Has the height of the pick mechanism fallen below the first pick height?
YES
NO
B
Pick mechanism has reached a second pick height
B75
Raise the lift plate and the media stack to raise pick mechanism a predetermined distance D within the second light blocking region
B80
Drive the pick mechanism to feed a media sheet from the media stack
B85
B90
Has the height of the pick mechanism fallen below the second pick height?
YES
NO

FIGURE 21

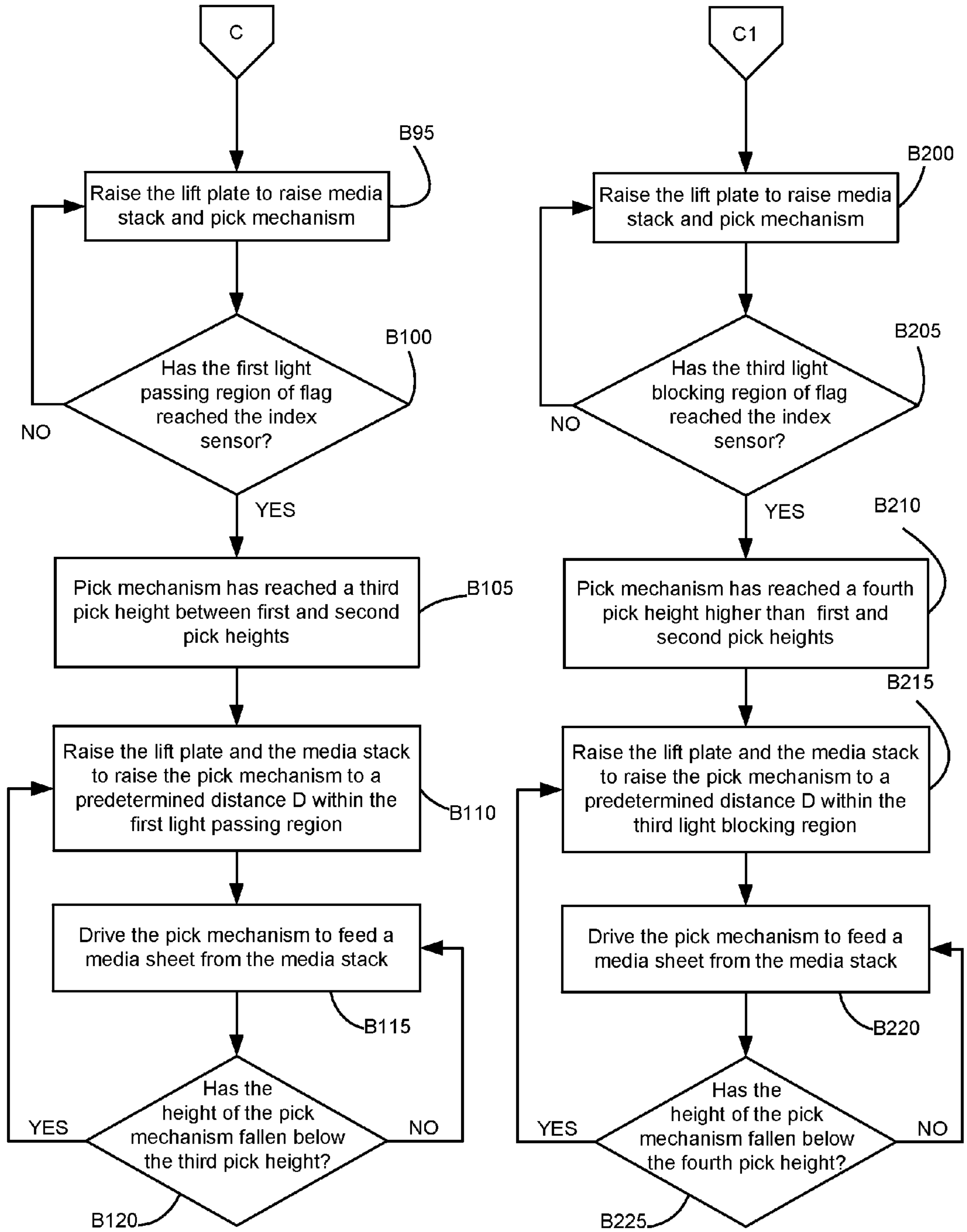
C
Raise the lift plate to raise media stack and pick mechanism
B95
Has the first light passing region of flag reached the index sensor?
B100
NO
YES
Pick mechanism has reached a third pick height between first and second pick heights
B105
Raise the lift plate and the media stack to raise the pick mechanism to a predetermined distance D within the first light passing region
B110
Drive the pick mechanism to feed a media sheet from the media stack
B115
Has the height of the pick mechanism fallen below the third pick height?
YES
NO
B120
C1
Raise the lift plate to raise media stack and pick mechanism
B200
Has the third light blocking region of flag reached the index sensor?
B205
NO
YES
B210
Pick mechanism has reached a fourth pick height higher than first and second pick heights
B215
Raise the lift plate and the media stack to raise the pick mechanism to a predetermined distance D within the third light blocking region
Drive the pick mechanism to feed a media sheet from the media stack
B220
Has the height of the pick mechanism fallen below the fourth pick height?
YES
NO
B225

FIGURE 22

SYSTEM AND METHOD FOR ADJUSTING A PICK HEIGHT OF A PICK MECHANISM IN AN IMAGE FORMING DEVICE

CROSS REFERENCES TO RELATED APPLICATIONS

None.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

None.

REFERENCE TO SEQUENTIAL LISTING, ETC.

None.

BACKGROUND

1. Field of the Invention

The field relates generally to media input feed systems for an image forming device ("IFD") having a removable input tray, and, more particularly, to systems and methods for adjusting a pick height of a pick mechanism based on media type.

2. Description of the Related Art

IFDs, such as printers, scanners and photocopiers utilize media feed mechanisms for feeding various types of media sheets into the IFDs. Examples of the various types of media sheets include, but are not limited to, printing paper, bond paper, coated paper, fabrics, transparencies and labels. Almost all of the media feed mechanisms include a pick roller that feeds a media sheet into the IFD for further processing. In a media feed mechanism, various arrangements of the pick roller may exist for feeding the media sheet into the IFD.

Prior pick mechanisms were designed to swing down into the media tray and onto the media stack, and an elevator is used to lift the media stack up to the pick mechanism to raise the pick mechanism and adjust the pick height. The angle at which the pick mechanism contacts the media stack typically provides a corresponding normal force which is applied substantially perpendicular to the flat surface of the media sheet by the pick roller. The pick mechanism also includes a flag that is used in conjunction with a sensor to determine whether or not the pick mechanism is at a standard pick height. Typically, the flag actuates the sensor at a specific pick height location to indicate that the pick mechanism is at the standard pick height. This arrangement, however, has only one available pick height for all types of the media sheets.

As is known, media may have different densities, weights, thicknesses and stiffnesses such that the normal force required to feed one type of media into the IFD may need to be different from the normal force required to feed another type of media in order to avoid multiple feeds or misfeeds. For example, normal media, such as copy paper or bond paper, may be reliably fed by the pick mechanism at the standard pick height, but compressible media, such as envelopes or labels having RFID tags, may compress when picked at the same pick height and drop below the desired pick location due to the pick load from the pick mechanism. Further, the compression could push the compressible media down to pick against a vertical portion of a media dam or separator bracket which could cause a failure to feed. In another example, when heavier or stiffer media, such as cardstock, are picked at the same standard pick height, the leading edge of the heavier media strikes the separator system at a different angle than normal media and can tend to push out the media tray due to the separator system force applied to the stiffer media at that angle. Thus, having only one available pick height for all types of media sheets can result in difficulty with feeding certain media types, and in some cases cause failure to feed.

Accordingly, there is a need for an improved media feed system that can work reliably with different types of media.

SUMMARY OF THE INVENTION

Disclosed is a media feeding system for an IFD that can compensate for variations in media type by providing a pick mechanism that enables different pick heights for different media types. The media feeding system comprises an input media tray having a bottom with a raisable lift plate for holding a media stack of one or more media sheets, and a pick mechanism rotatably coupled to a drive assembly for feeding a topmost media sheet from the media stack. The pick mechanism includes a flag having a first and a second light blocking region, and a first light passing region therebetween. An optical sensor is mounted adjacent the input media tray. The optical sensor includes an emitter and a photo-receiver spaced to allow the flag to pass therebetween and provides an output signal that changes between a first state and a second state as the light blocking and light passing regions of the flag pass between the emitter and the photo-receiver, the output signal being representative of a position of the pick mechanism that changes as the height of the media stack changes. A lift mechanism is operably coupled to the lift plate for raising the lift plate, and a controller is operably coupled to the optical sensor, the drive assembly and the lift mechanism. The controller controls the lift mechanism to initialize the lift plate to a height in which the flag is positioned below the optical sensor and the output signal of the optical sensor is in the first state, and determines a media type for the stack of media sheets on the lift plate. When the media type determined is a first media type, the controller controls the lift mechanism to raise the lift plate to raise the stack of media sheets and the pick mechanism until the first light blocking region is positioned between the emitter and the photo-receiver changing the output signal from the first state to the second state indicating that the pick mechanism has reached a first pick height. When the media type determined is a second media type, the controller controls the lift mechanism to raise the lift plate to raise the stack of media sheets and the pick mechanism until the second light blocking region is positioned between the emitter and the photo-receiver changing the output signal from the first state to the second state back to the first state and then back to the second state indicating that the pick mechanism has reached a second pick height different from the first pick height.

Further disclosed is a method for adjusting a pick height of the pick mechanism which includes initializing a position of the flag to be below the optical sensor by controlling a height of the lift plate such that an optical path of the optical sensor is unobstructed by the flag arm and the signal output of the optical sensor is in a first state, and determining a media type for the media stack. When the media type determined is a first media type, the lift plate is raised to raise the media stack and the pick mechanism until the first light blocking region blocks the optical path of the optical sensor and changes the signal output from the first state to a second state indicating that the pick mechanism has reached a first pick height. When the media type determined is a second media type, the lift plate is raised to raise the media stack and the pick mechanism such that the first light blocking region first blocks the optical path and changes the signal output from the first state to the second

state, the first light passing region subsequently unblocks the optical path and changes the signal output from the second state to the first state, and then the second light blocking region subsequently blocks the optical path and changes the signal output from the first state to the second state indicating that the pick mechanism has reached a second pick height different from the first pick height. When the media type determined is a third media type, the lift plate is raised to raise the media stack and the pick mechanism such that the first light blocking region first blocks the optical path and changes the signal output from the first state to the second state, and then the first light passing region subsequently unblocks the optical path and changes the signal output from the second state to the first state indicating that the pick mechanism has reached a third pick height between the first and second pick heights.

Additional light blocking and light passing regions may be provided in the flag to allow for additional pick heights for additional media types.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and advantages of the disclosed embodiments, and the manner of attaining them, will become more apparent and will be better understood by reference to the following description of the disclosed embodiments in conjunction with the accompanying drawings.

FIG. **1** is a schematic view of an imaging system according to one example embodiment.

FIG. **2** is an illustration of an IFD with an option assembly according to one example embodiment.

FIG. **3** is an illustration of a removable media input tray with a pick mechanism and drive system according to one example embodiment.

FIG. **4** is a top view of the removable media input tray, pick mechanism and drive system of FIG. **3**.

FIG. **5** is a perspective view of a drive mechanism connected to a lift plate according to one example embodiment.

FIG. **6** is a perspective view of a drive transmission according to one example embodiment.

FIG. **7** is a side elevation view of the drive transmission in FIG. **6** according to one example embodiment.

FIG. **8** is a side elevation view of a motor coupled to an encoder wheel according to one example embodiment.

FIGS. **9-10** are left and right perspective views of the pick mechanism including a flag having two light blocking regions and a light passing region therebetween according to one example embodiment.

FIG. **11** is a rear view of the pick mechanism illustrated in FIGS. **9-10**.

FIG. **12** is a view of the pick mechanism including a flag having three light blocking regions and two light passing regions according to one example embodiment.

FIG. **13** is a section view of the removable media input tray illustrating a media stack elevated within a media storage location by a lift plate to contact the pick mechanism.

FIGS. **14**A-**141** illustrate sequential actions of the index sensor as the pick mechanism, the media stack and the lift plate are raised.

FIG. **15** illustrates a signal representation of the output of the index sensor as different regions of the flag move relative to the index sensor as the pick mechanism is raised.

FIGS. **16-17** illustrate different positions of the pick mechanism with light blocking regions of the flag blocking an optical path of the index sensor.

FIGS. **18-19** illustrate different positions of the pick mechanism with light passing regions of the flag unblocking the optical path of the index sensor.

FIGS. **20-22** illustrate a flowchart of a method for adjusting the pick height of the pick mechanism based on media type.

DETAILED DESCRIPTION

It is to be understood that the present application is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. The present disclosure is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless limited otherwise, the terms "connected," "coupled," and "mounted," and variations thereof herein are used broadly and encompass direct and indirect connections, couplings, and mountings. In addition, the terms "connected" and "coupled" and variations thereof are not restricted to physical or mechanical connections or couplings.

In addition, it should be understood that embodiments of the present disclosure include both hardware and electronic components or modules that, for purposes of discussion, may be illustrated and described as if the majority of the components were implemented solely in hardware. However, one of ordinary skill in the art, and based on a reading of this Detailed Description, would recognize that, in at least one embodiment, the electronic based aspects of the present disclosure may be implemented in software. As such, it should be noted that a plurality of hardware and software-based devices, as well as a plurality of different structural components may be utilized to implement the present disclosure. Furthermore, and as described in subsequent paragraphs, the specific mechanical configurations illustrated in the drawings are intended to exemplify embodiments of the present disclosure and other alternative mechanical configurations are possible.

It will be further understood that each block of the diagrams, and combinations of blocks in the diagrams, respectively, may be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer, processor, or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus may create means for implementing the functionality of each block or combinations of blocks in the diagrams discussed in detail in the descriptions below. These computer program instructions may also be stored in a non-transitory, tangible, computer readable storage medium that may direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer readable storage medium may produce an article of manufacture including an instruction means that implements the function specified in the block or blocks. Computer readable storage medium includes, for example, disks, CD-ROMS, Flash ROMS, nonvolatile ROM and RAM. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions that execute on the computer or other programmable apparatus implement the functions specified in the block or blocks. Output of the computer program instructions may be displayed in a user interface or computer display of the computer or other programmable apparatus that implements the functions or the computer program instructions.

As used herein, the term "communication link" is used to generally refer to structure that facilitates electronic communication between multiple components, and may operate using wired or wireless technology. A communication link may be a direct electrical wired connection, a direct wireless connection (e.g., infrared or r.f.), or a network connection (wired or wireless), such as for example, an Ethernet local area network (LAN) or a wireless networking standard, such as IEEE 802.11. While several communication links are shown, it is understood that a single communication link may serve the same functions as the multiple communication links that are illustrated.

The term "image" as used herein encompasses any printed or electronic form of text, graphics, or a combination thereof. "Media" or "media sheet" refers to a material that receives a printed image or, with a document to be scanned, a material containing a printed image. The media is said to move along the media path and the media path extensions from an upstream location to a downstream location as it moves from the media trays to the output area of the IFD. For each option tray, the top of the option tray is downstream from the bottom of the option tray. Conversely, the bottom of the option tray is upstream from the top of the option tray. Further, the media is conveyed using pairs of rolls that form nips therebetween. The term "nip" is used in the conventional sense to refer to a nip formed between two rolls that are located at about the same point in the media path and have a common point of tangency to the media path. Further relative positional terms are used herein. For example, "superior" means that an element is above another element. Conversely "inferior" means that an element is below or beneath another element. "Media process direction" describes the movement of media within the imaging system and is generally meant to be from an input toward an output of the imaging system. The explanations of these terms along with the use of the terms "top," "bottom," "front," "rear," "left," "right," "up," and "down" are made to aid in understanding the spatial relationship of the various components and are not intended to be limiting.

Referring now to the drawings and particularly to FIGS. **1**-**2**, there is shown a schematic depiction of an imaging system **1**. As shown, imaging system **1** may include an IFD **2**, an optional computer **17** and/or one or more option assemblies **50** attached to the IFD **2**. IFD **2** is shown as a multifunction machine that includes a controller **3**, a print engine **4**, a printing cartridge **5**, a scanner system **6**, and a user interface **7**. IFD **2** may also be configured to be a printer without scanning IFD **2** may communicate with computer **17** via communication link **18** using a standard communication protocol, such as for example, universal serial bus (USB), Ethernet or IEEE 802.xx. A multifunction machine is sometimes referred to in the art as an all-in-one (AIO) unit. Those skilled in the art will recognize that IFD **2** may be, for example, an ink jet printer/copier; an electrophotographic printer/copier; a thermal transfer printer/copier; other mechanisms including at least scanner system **6** or a standalone scanner system.

Controller **3** includes a processor unit and associated memory **8**, and may be formed as one or more Application Specific Integrated Circuits (ASIC). Memory **8** may be any volatile or non-volatile memory of combination thereof such as, for example, random access memory (RAM), read only memory (ROM), flash memory and/or non-volatile RAM (NVRAM). Alternatively, memory **8** may be in the form of a separate electronic memory (e.g., RAM, ROM, and/or NVRAM), a hard drive, a CD or DVD drive, or any memory device convenient for use with controller **3**. In one embodiment, controller **3** communicates with print engine **4** via a communication link **9**. Controller **3** communicates with scanner system **6** via a communication link **10**. User interface **7** is communicatively coupled to controller **3** via a communication link **11**. User interface **7** may include firmware maintained in memory **8** which may be performed by controller **3** or another processing element. Controller **3** may be, for example, a combined printer and scanner controller. Controller **3** serves to process print data and to operate print engine **4** during printing, as well as to operate scanner system **6** and process data obtained via scanner system **6**. Controller **3** may also be connected to computer **17** via communication link **18** where status indications and messages regarding the media and IFD **2** may be displayed and from which operating commands may be received. Computer **17** may be located nearby IFD **2** or remotely connected to IFD **2**. In some circumstances, it may be desirable to operate IFD **2** in a standalone mode. In the standalone mode, IFD **2** is capable of functioning without a computer.

Controller **3** also communicates with a controller **53**, via communication links **13** and **16**, provided within each attached option assembly **50**. Controller **53** operates various motors housed within option assembly **50** that position media for feeding, feed media from media path branches PB into media path P or media path extensions PX as well as feed media along media path extensions PX and media path P and control the travel of media along media path P and media path extensions PX.

IFD **2** and option assembly **50** each also include a media feed system **12** having a pick mechanism **300**, a drive assembly **400** and removable media input tray **100** for holding a media stack MS containing one or more media sheets M to be printed. Media input tray also includes a media dam **150**, a feed roll assembly **160**, and a lift mechanism **200**. In IFD **2**, pick mechanism **300** and lift mechanism **200** are mechanically coupled to drive assembly **400** that is controlled by controller **3** via communication link **13**. In option assembly **50**, pick mechanism **300** and lift mechanism **200** are mechanically coupled to drive assembly **400** that is controlled by controller **3** via controller **53**. In both IFD **2** and option assembly **50**, pick mechanism **300** is used to drive a topmost media sheet M from the media stack MS into media dam **150** which directs the picked sheet into media path P or extension PX, and lift mechanism **200** is used to lower or raise a lift plate **172** and the media stack MS relative to pick mechanism **300**. In IFD **2**, media path P (shown in dashed line) is provided from the removable media input tray **100** extending through the print engine **4** and scanner system **6** to an output area **38** and to a duplexing path or to various finishing devices if provided. Media path P may also have extensions PX and/or branches PB (shown in dotted line) from or to other removable media input trays as described herein such as that shown in option assembly **50**. Media path P may include a multipurpose input tray **40** and corresponding path branch PB that merges with the media path P within IFD **2**. Along the media path P and its extensions PX are provided media sensors **240**, **242** which are used to detect the position of the media sheet, usually the leading and trailing edges of the media sheet, as it moves along the media path P. Media type sensors **230** are provided in IFD **2** and each option assembly **50** to sense the type of media being fed from removable media input tray **100**.

Media sensors **228** are provided in IFD **2** and each option assembly **50** to sense the size of media being feed from removable media input tray **100**. Media sensors **240**, **242** positioned along media path P and its extension PX and media sensors **230**, **228** are shown in communication with controller **3** via communication link **16**. Media sensor **240** senses a media sheet on media path P and extension PX while media sensor **242** senses a media sheet in path branch PB that is being picked from media storage area **140** of the internal removable media input tray **100**. Downstream of removable media input tray **100** in IFD **2**, a media sensor **19**, communicatively coupled to controller **3** via communication link **16**, is positioned along the media path P to sense the presence of, as well as, the leading and trailing edges of a media sheet being fed from multipurpose input tray **40**, from removable media input tray **100** within IFD **2** and media being fed from option assembly **50**.

FIG. **2** illustrates IFD **2** that includes the removable media input tray **100** that is integrated into a lower portion of the housing **20** of IFD **2**. Housing **20** has a front **22**, first and second sides **24**, **26**, rear **28**, top **30** and bottom **32**. User interface **7** comprising a display **34** and a key panel **36** may be located on the front **22** of housing **20**. Using the user interface **7**, a user is able to enter commands and generally control the operation of the IFD **2**. For example, the user may enter commands to switch modes (e.g., color mode, monochrome mode), view the number of images printed, take the IFD **2** on/off line to perform periodic maintenance, and the like. A media output area **38** is provided in the top **30**. Multipurpose media input tray **40** folds out from the front **22** of housing **20** which may be used for handling envelopes, index cards or other media for which only a small number of media will be printed. Hand grips **42** are provided in several locations on housing **20**, such as on sides **24**, **26**, along the top of multipurpose media tray **40**, and on the front of removable media input tray **100**. Also various ventilation openings, such as vents **44** are provided at locations on first and second sides **24**, **26** and top **30**.

FIG. **2** also illustrates IFD **2** having an option assembly **50** comprising removable media input tray **100**, a housing **60** in which removable media input tray **100**, pick mechanism **300**, and drive mechanism **400** are contained. IFD **2** sits on top of option assembly **50** forming a stack. Latches and alignment features are provided between adjacent units. An adjacent unit is either an IFD **2** or another option assembly **50**. Additional option assemblies **50** may be added between the attached option assembly **50** or below it. As each option assembly **50** is added, an extension PX to the media path P is also added. The media path extension PX within each option assembly **50** is comprised of two branches which eventually merge at a point above their respective housing **60**, either, depending on location within the stack, within a superior option assembly **50** or within IFD **2** itself.

Media sheets M are introduced from removable media input tray **100** and moved along the media path P and or a path extension PX during the image formation process. Each removable media input tray **100** is sized to contain a media stack MS of media sheets that will receive a color and/or monochrome image. Each removable media input tray **100** may have the same or similar features. Each removable media input tray **100** may be sized to hold the same number of media sheets or may be sized to hold different quantities of media sheets. In some instances, the removable media input tray **100** found in IFD **2** may hold a lesser, equal or greater quantity of media than a removable media input tray **100** found in an option assembly **50**.

Referring to FIGS. **3-4**, removable media input tray **100** has a front wall **102**, side walls **104**A, **104**B, a rear wall **106**, and a bottom **108**. Attached to a front surface of front wall **102** is panel **110** having hand grip **42** therein (See FIG. **2**). Panel **110** is illustrated as being attached to front wall **102** by fasteners **112**. Front wall **102** may be further defined by front portion **114** having a height H**1**, a rear portion **116** spaced apart from front portion **114** and having a height H**2** that is less than height H**1**, with side portions **118**A, **118**B adjacent side walls **104**A, **104**B, respectively, connecting front and rear portions **114** and **116**, and a top portion **122**. Media dam **150** on front wall **102** contains a pair of spaced apart separator rollers **152** projecting through corresponding openings **154** in media contact surface **156**. In other embodiments, a sloped media dam extends from the top of rear portion **116** to the top portion **122** of front wall **102** and between side portions **118**A, **118**B of front wall **102** and may be molded into the front wall **102**. In either of these embodiments, media contact surface **156** forms an obtuse angle with the bottom **108**. Also, the combination of rear portion **116** and media contact surface **156** may be referred to as a media dam having a vertical portion (rear portion **116**) and an angled or sloped portion (media contact surface **156**). In front of media dam **150**, a channel **126** is provided to allow for a media sheet M to pass through removable media input tray **100** from an inferior unit to a superior unit.

Rearward of front wall **102** is media storage area **140** for media that will be fed to IFD **2** and is generally defined by front wall **102** and side walls **104**A, **104**B and bottom **108**. As illustrated, rear wall **106** encloses media storage area **140**. Alternate embodiments of removable media input tray **100** may not include a rear wall **106**. Media storage area **140** may be open or enclosed. Within media storage area **140** are rear and side media restraints **170**, **171**, and lift plate **172**. Media stack MS is placed on lift plate **172** which is positioned between side walls **104**A, **104**B and is dimensioned to hold the widest media for which removable media input tray **100** is designed to hold. As illustrated, the length of lift plate **172** is shorter than the length of the longest media for which removable media input tray is designed in that most media have a modicum of pliability. Example media sizes include, but are not limited to, A6, A4, A3, Letter, Legal, and Ledger. Openings **174**, **175** are provided in lift plate **172** to accommodate the adjustment of rear and side media restraints **170**, **171**, which are slidably attached to bottom **108**, while allowing lift plate **172** to be raised or lowered. Provided near the rear end **178** of the lift plate **172** are a pair of opposed pivot arms **180**A, **180**B that extend vertically upward from the lift plate **172** parallel to side walls **104**A, **104**B, respectively. Openings **182**A, **182**B are provided adjacent the upper ends of pivot arms **180**A, **180**B, respectively, which are received on corresponding bearing posts **184**A, **184**B provided on side walls **104**A, **104**B, respectively. The use of the pivot arms **180**A, **180**B raises a pivot axis **185** (see FIG. **5**) of lift plate **172** from the bottom **108** to about the centerline of bearing posts **184**A, **184**B, a distance of about 30 mm. When media storage location **140** is at capacity, this places the leading edge of the top-most media proximate the top of rear portion **116**. The location of axis **185** may be designed such that it would be approximately at the mid-point of the rated capacity for the removable media input tray **100**. For example, if a filled removable media input tray **100** is designed to hold a media stack of about 50 mm in height, then pivot axis **185** would be located at about 25 mm from the top surface of lift plate **172**. Raising pivot axis **185** of lift plate **172** reduces the amount of fanning or shingling that occurs in the leading edges of media sheets M in the media stack MS as it is raised up to pick mechanism **300** for feeding and provides near straight-line motion of the leading edges of the media sheets M. However other locations for the pivot axis **185** may also be used with media dam **150**. In one example, the leading edge of lift plate **172** travels about 60 mm between its position on the bottom **108** of media input tray **100** to its highest position when it is empty of media sheets.

Media restraints **170**, **171** are adjustable and lockable within tracks **186**, **187** provided in bottom **108** to accommodate various lengths and widths of media in removable media input tray **100**. Track **186** allows rear media restraint **170** to move from a distal position near rear wall **106** to a proximal position approximately midway along side walls **104**A, **104**B. Track **187** allows side media restraint **171** to laterally move from a position adjacent side wall **104**B to a position approximately 80 mm from side wall **104**A. This allows removable media input tray **100** to hold a narrow compressible media, such as envelopes, for feeding. Side media restraint **171** has at least one vertically extending media biasing member **188** to bias a topmost portion of the media toward a side wall **104**A for aligning media to the media path P and media edge reference surface **105**. Biasing member **188** may extend the height of side media restraint **171** or may extend only a portion of its height. Rear media restraint **170** has a spring-bias angled plate **189** that abuts the trailing edges of the media sheets M and angles or rotates outwardly from the bottom of rear media restraint **170** while pivoting about an axis near the top of angled plate **189**. Angled plate **189** helps to reduce fanning or shingling of the leading edges of media sheets M of the media stack MS as it is elevated into picking position within housing **20** or housing **60** by applying greater biasing on the lower portion of the media stack MS in the media process direction than is applied at the top of angled plate **189**.

Guide rails **190**A, **190**B are also provided on the side walls **104**A, **104**B, respectively, in addition to guide rollers **192** located on the distal end of side walls **104**A, **104**B near rear wall **106** to assist with insertion and removal of removable media input tray **100** from housing **20** or housing **60**. For purposes of clarity, also shown in FIGS. **3-4** are pick mechanism **300** and drive mechanism **400** and their relation to removable media input tray **100** when installed in housing **60**. As illustrated, pick mechanism **300** is connected to and supported by drive mechanism **400**. A frame **402** mounted to housing **20** supports drive mechanism **400**. Drive mechanism **400** is also provided in housing **60**. Other mounting configurations for pick mechanism **300** may also be used.

With reference to FIGS. **5-8**, drive mechanism **400** according to an example embodiment is shown. Drive mechanism **400** includes a motor **404** that drives pick mechanism **300** and lifts lift plate **172**. Drive transmission **401** is shown having an input **401**A connected to motor **404**. Drive transmission **401** includes a first output **401**B connected to pick mechanism **300** and a second output **401**C connected to lift plate **172**. While the example embodiment shown includes two outputs **401**B, **401**C, additional outputs may be provided as desired for performing additional functions.

A drive pinion **406** extends from motor **404** and connects to drive transmission **401** to transfer rotational force from motor **404** to drive transmission **401**. In the example embodiment shown, drive pinion **406** is connected to a speed reducer dual gear **408** that includes a larger portion **408**A and smaller portion **408**B. Pinion **406** is connected to larger portion **408**A while smaller portion **408**B is connected to an intermediary gear **410**. It will be appreciated that in this configuration, the rotational speed of intermediary gear **410** is less than the rotational speed of motor **404** and drive pinion **406** as a result of the difference between the circumferences of larger portion **408**A and smaller portion **408**B of speed reducer dual gear **408**. Alternatives include those wherein the orientation of larger portion **408**A and smaller portion **408**B is reversed so that the rotational speed of intermediary gear **410** is greater than the rotational speed of motor **404** and drive pinion **406**. Further alternatives include those wherein speed reducer dual gear **408** is replaced with a simple intermediary gear so that the rotational speed of intermediary gear **410** is the same as the rotational speed of motor **404** and drive pinion **406**.

A pick mechanism drive gear **412** is connected to intermediary gear **410**. A pick mechanism drive shaft **426** is substantially concentric with and extends from pick mechanism drive gear **412**. Drive shaft **426** is positioned by a bearing sleeve **427** relative to frame **402**. Bearing sleeve **427** is mounted in a hole in frame **402** and is disposed around drive shaft **426** so that drive shaft **426** is free to rotate. Drive shaft **426** extends from frame **402** in a cantilevered fashion and includes a free end **430**. Pick mechanism **300** is removably mountable on free end **430** of drive shaft **426**. When pick mechanism **300** is mounted on drive shaft **426**, drive shaft **426** transfers rotational force to a drive transmission, such as a gear train, within transmission housing **340** for driving the pick wheels **322**.

A first clutched gear **414** is connected to first output **401**B of drive transmission **401**. In the example embodiment shown, first clutched gear **414** is positioned around drive shaft **426**. A second clutched gear **416** is connected to first clutched gear **414** and second output **401**C of drive transmission **401**. First and second clutched gears **414**, **416** each include a one-way clutch. In the example embodiment shown, second clutched gear **416** is connected to an intermediary gear **418** protruding through top of the side wall **104**A of the media input tray **100**. Intermediary gear **418** is connected to a sector gear **422** pivotally mounted in side wall **104**A. In the example embodiment illustrated, intermediary gear **418** is connected to sector gear **422** via an additional intermediary gear **420** in side wall **104**A. A lift arm **173** is positioned beneath lift plate **172** and is connected to drive mechanism **400**. Lift arm **173** extends through side wall **104**A toward side wall **104**B and is used to elevate lift plate **172** and media stack MS up to pick mechanism **300** for feeding media sheets M into media path P. Lift arm **173** is mounted to sector gear **422** through a radially oriented opening **424** in sector gear **422**. Lift arm **173** is slidably disposed between bottom **108** and a bottom surface **172**A of lift plate **172**. Accordingly, rotation of sector gear **422** in one direction rotates lift arm upward against bottom surface **172**A thereby rotating lift plate **172** about pivot axis **185**.

The engagement of first clutched gear **414** is opposite the engagement of second clutched gear **416**. Clutched gears **414**, **416** are configured so that when pick mechanism **300** is driven in the media process direction for feeding media sheets M, lift plate **172** is held in place during feeding of media. When elevation of lift plate **172** is called for as media is removed during media feeding, motor **404** rotation is reversed raising lift plate **172** while reversing the rotation of pick mechanism **300** to be opposite the media process direction. In the example embodiment shown, when motor **404** drives the pick mechanism **300** in the media process direction, first clutched gear **414** is disengaged so that it does not rotate with drive shaft **426** and second clutched gear **416** is engaged to hold lift plate **172** in place. Pick mechanism **300** as illustrated may be rotated downward from the horizontal position through an arc of about 20 degrees with the nominal operating range being between 10 to 16 degrees. When motor **404** drives pick mechanism **300** opposite to the media process direction, first clutched gear **414** is engaged so that it rotates with drive shaft **426** as it is driven by motor **404** and second clutched gear **416** is disengaged and driven by first clutched gear **414** to rotate sector gear **422**. Rotation of the sector gear **422** raises lift arm **173** and, in turn, raises lift plate **172**.

Motor **404** includes an encoder wheel **490** that rotates with motor **404** providing encoder pulses indicative of the rotation of motor **404**. As encoder wheel **490** rotates, an encoder wheel sensor **492** provides an output **494** in the form of pulses to controllers **3**, **53** that allows controllers **3**, **53** to track the rotation of encoder wheel **490** and motor **404** which may be used to track movement of lift plate **172** and rotation of pick mechanism **300**.

Referring to FIGS. **9-10**, pick mechanism **300** is shown in further detail. Pick mechanism **300** comprises drive transmission **304**, a pick axle assembly **320** and a transmission housing **340** for reversible drive transmission **304**. Drive transmission **304** is at one end operatively connected to pick drive shaft **426** extending from drive mechanism **400** mounted on housing **20** of IFD **2** or housing **60** of option assembly **50**. At its other end, drive transmission **304** is coupled to a pick axle assembly **320** having a pick wheel **308** mounted at each end. Other configurations of pick wheels may also be used. For example, a single pick wheel or three pick wheels may be mounted on pick axle assembly **320**. In operation, when pick drive shaft **426** is rotated, torque is transferred through to drive transmission **304** to pick axle assembly **320** which drives pick wheels **308**. A releasable latch **360** is mounted on the exterior of side **348** of transmission housing **340** and has an opening centered about the free end **430** of drive shaft **426** allowing latch **360** to be slid onto pick drive shaft **426**. Latch **360** engages a circumferential groove **429** provided near free end **430** of drive shaft **426**. Opposed resilient members **368** have ends **370** that engage with circumferential groove **429** and axially position pick mechanism **300** on pick drive shaft **426**. Removal of pick mechanism **300** is accomplished by the user pressing resilient members **368** inwardly toward drive shaft **426** separating and releasing ends **370** from groove **429** and permitting pick mechanism **300** to be slid off drive shaft **426**. When installing pick mechanism **300**, a user simply slides pick mechanism **300** onto drive shaft **426**. Free end **430**, which in one embodiment is rounded, acts to separate ends **370** as pick mechanism **300** is slid into position on drive shaft **426**. Ends **370** eventually snap into groove **429** to position pick mechanism **300** on pick drive shaft **426**. The design and mounting of pick mechanism **300** should not be considered as a limitation of the present disclosure. Other types of pick mechanisms and mounting configurations may be used.

A flag **380** also extends outwardly from transmission housing **340** and is used to change the state of an index sensor **480** which is used for feeding media sheets M from removable media input tray **100**. As illustrated, flag **380** extends outwardly from a side **346** of transmission housing **340**. While latch **360** and flag **380** are shown as mounted on opposite sides of transmission housing **340**, they can be mounted on the same side. Index sensor **480** is positioned on frame **402** adjacent to the drive shaft **426** and is in operable communication with controller **3**, **53** via communication links **13**, **16** and provides an output signal representative of a position of pick mechanism **300** that changes as the height of the media stack MS of media sheets M changes. In the example embodiment illustrated, index sensor **480** is an optical sensor having an optical path between a pair of opposed arms comprising an emitter **481**, which emits optical energy along an optical path **483**, and a photo-receiver **482**, which receives optical energy from emitter **481**, that are spaced to allow flag **380** to pass therebetween. However, any suitable sensor may be used. In operation, lift plate **172** is raised in indexed moves based on the output signal of index sensor **480** in order to ensure that the top of the media stack MS is within a desired pick height.

In accordance with example embodiments of the present disclosure, flag **380** may include multiple light blocking regions separated therebetween by a light passing region, thereby forming an alternating pattern of light blocking and light passing regions that change the state of index sensor **480** between a first state and a second state as each region moves into the optical path as the position of pick mechanism **300** changes. In the example embodiments shown in FIGS. **9-11**, flag **380** includes a first light blocking region **382-1** starting at the top of flag **380**, a second light blocking region **382-2**, and a first light passing region **384-1** therebetween. In the example embodiment illustrated in FIG. **12**, flag **380** includes first and second light blocking regions **382-1**, **382-2** separated therebetween by first light passing region **384-1**, and a third light blocking region **382-3** separated from second light blocking region **382-2** by a second light passing region **384-2**. In other example embodiments, the number of light blocking regions and light passing regions provided in flag **380** is a matter of design choice. Generally, the light blocking regions **382** and light passing regions **384** are used in adjusting the position of pick mechanism **300** to at least two different pick heights to accommodate different types of media sheets, as will be explained in greater detail below. Further, the number of light blocking regions **382** and light passing regions **384** may vary based on media feed performance for certain media types and the pick location that is needed.

In one example embodiment, light blocking regions **382-1-382-3** comprise opaque solid sections of flag **380** while light passing regions **384-1**, **384-2** comprise openings or slots formed on flag **380**. In an alternative example embodiment, flag **380** may be molded having transparent/translucent and opaque regions, with the opaque regions forming the light blocking regions and the transparent/translucent regions forming the light passing regions. In another alternative example embodiment, flag **380** may be provided as a translucent or transparent material and the light blocking regions **382-1-382-3** may be achieved by varying the opacity of portions of flag **380**, such as by applying coatings or stickers to such portions of flag **380**, and the remaining uncoated portions of flag **380** may form the light passing regions.

With reference to FIG. **13**, in order to index lift plate **172**, motor **404** drives pick mechanism **300** opposite the media process direction and raises lift arm **173**, and in turn, raises lift plate **172**, in order to raise the media stack MS. Initially, when removable media input trays **100** are inserted into housings **20**, **60**, lift plate **172** is initialized to a height in which flag **380** is positioned below index sensor **480** such that the optical path of index sensor **480** is unobstructed by flag **380** and the output signal of index sensor **480** is in the first state. As the lift plate **172** is raised and when the top of the media stack MS contacts the pick mechanism **300**, the media stack MS pushes pick mechanism **300** up until flag **380** enters into and passes between opposed arms **481**, **482** of index sensor **480**, as illustrated in FIG. **13**. When a light blocking region blocks the optical path of index sensor **480**, the output signal of index sensor **480** is in the second state. Conversely, when a light passing region unblocks the optical path of index sensor **480**, the output signal of index sensor **480** is in the first state. Thus, as flag **380** is raised continuously upward from its initial position below index sensor **480** and as the light blocking regions **382-1-382-3** and light passing regions **384-1**, **384-2** sequentially pass between opposed arms **481**, **482**, the output signal of index sensor **480** has multiple transitions between the first state and the second state. In accordance with example embodiments of the present disclosure, the light blocking regions **382-1-382-3** and light passing regions **384-1**, **384-2** which cause the output signal transitions to occur are used to indicate whether or not pick mechanism **300** has reached a desired pick height for picking media sheets of a particular type. As such, different regions of flag **380** can block and/or unblock index sensor **480** at multiple locations and enable different pick heights for pick mechanism **300** to accommodate different media types.

Operation between flag **380** and index sensor **480** will now be described with reference to FIGS. **14**A-**141** illustrating sequential actions of pick mechanism **300** as lift plate **172** is raised by lift mechanism **200** from a height H**1** to a height H**9** and with flag **380** having three light blocking regions **382-1**-**382-3** and two light passing regions **384-1**, **384-2**; FIG. **15** showing an example output signal **484** of index sensor **480** as different regions of flag **380** move into and out of the optical path **483** of index sensor **480** as pick mechanism **300** is raised; and, FIG. **16** showing in more detail the three light blocking regions **382-1**-**383-3** and two light passing regions **384-1**, **384-2** of flag **380** illustrated in FIGS. **14**A-**141** relative to the optical path **483** of index sensor **480**.

In the example illustration shown in FIGS. **14**A-**141** and **16**, flag **380** includes first light blocking region **382-1**, first light passing region **384-1**, second light blocking region **382-2**, second light passing region **384-2**, and third light blocking region **382-3** arranged sequentially relative to a direction of motion of flag **380** with the first light blocking region **382-1** at the uppermost end of flag **380** being the first to reach index sensor **480** as flag **380** is raised from its initial position below index sensor **480**, and third light blocking region **382-3** at the lowermost end thereof being the last to reach index sensor **480** relative to the upward motion of flag **380**. In FIGS. **14**A-**141**, the light blocking regions **382-1**-**382-3** and light passing regions **384-1**, **384-2**, are labeled only in FIG. **14**A for purposes of clarity. The size of each of light blocking regions **382-1**-**382-3** and/or each light passing region **384-1**, **384-2** may be determined based at least on a beam width of index sensor **480**. In one example embodiment, each light blocking region **382-1**-**382-3** and/or a light passing region **384-1**, **384-2** may be sized to have a height that at least corresponds to the sensor beam width and/or that accounts for tolerances in the media feed system and the index sensor **480** itself. For example, each light blocking region may be sized to sufficiently intercept and prevent optical energy from reaching photo-receiver **482** in order to allow detection of the light blocking region **382** by index sensor **480**, while each light passing region may be sized such that sufficient amount of optical energy is allowed to pass through in order to prevent a light passing region being not detected by index sensor **480** as flag **380** moves between emitter **481** and photo-receiver **482**. The light blocking and light passing regions may be of the same heights or different heights. Output signal **484** in FIG. **15** includes HIGH signal output levels corresponding to instances where the optical path **483** of index sensor **480** is unobstructed and in the first state, and LOW output signal levels corresponding to instances where the optical path is blocked by a light blocking region **382** of flag **380** and index sensor **480** is in the second state. Lift plate **172** is initially positioned at height H**1** whereby media stack MS contacts pick mechanism **300** and flag **380** is raised to a position below index sensor **480** as shown in FIG. **14**A. In this initial position, the output signal **484** of index sensor **480** is in the HIGH state as the optical path **483** is unblocked. In one example embodiment, for a sensor beam width of about 0.5 mm and a tolerance buffer of about ±0.2 mm, light blocking regions **382-1**-**382-3** and/or a light passing regions **384-1**, **384-2** may each have a height of at least about 1 mm or greater, such as 2 mm. Flag **380** in one form may have an overall length of about 12 mm while each of the light blocking and light passing regions may have a height of about 2 mm.

As lift plate **172** is raised to height H**2** as shown in FIG. **14**B, flag **380** is raised upward and first light blocking region **382-1** begins to move into and block optical path **483** which causes the output signal **484** to have a first transition **484-1** changing from the HIGH state to the LOW state. At height H**3** shown in FIG. **14**C, first light blocking region **382-1** continues to block the optical path **483**. As lift plate **172** is raised to height H**4** in FIG. **14**D, first light blocking region **382-1** moves out of the optical path **483** and first light passing region **384-1** subsequently unblocks the optical path **483** causing the output signal **484** to have a second transition **484-2**, changing from the LOW state to the HIGH state, following the first transition **484-1**. The optical path **483** remains unblocked as lift plate **172** is raised from height H**4** to height H**5** as shown in FIG. **14**E. In FIG. **14**F, lift plate **172** is raised to height H**6** moving first light passing region **384-1** out of the optical path **483** and moving second light blocking region **382-2** into and blocking the optical path **483** causing the output signal **484** to have a third transition **484-3**, changing from the HIGH state to the LOW state, following the second transition **484-2**. As lift plate **172** is raised further upward to height H**7**, as shown in FIG. **14**G, second light blocking region **382-2** moves out of the optical path **483** and second light passing region **384-2** subsequently moves into and unblocks the optical path **483** causing the output signal **484** to have a fourth transition **484-4**, changing from the LOW state to the HIGH state, following the third transition **484-3**. The optical path **483** of index sensor **480** remains unblocked by second light passing region **384-2** as lift plate **172** is raised to height H**8** as shown in FIG. **14**H. The optical path **483** is subsequently blocked by third light blocking region **382-3** as lift plate **172** is further raised upward to height H**9** as shown in FIG. **14**I causing the output signal **484** to have a fifth transition **484-5**, changing from the HIGH state to the LOW state, following the fourth transition **484-4**. As will be appreciated, reverse logic to that described may also be used. For example, alternative embodiments may incorporate sensor circuitries which generate output that is in a high state when the optical path is blocked and in a low state when the optical path is unblocked.

Media may have different densities, weights, thicknesses, stiffnesses and characteristics such that the pick height required to reliably feed one type of media may be different from the pick height required to reliably feed another type of media. In one example embodiment, the multiple locations at which light blocking regions **382-1**-**382-3** block the optical path of index sensor **480** may be used to adjust pick mechanism **300** to different pick heights for feeding different media types. In particular, lift plate **172** can be raised to raise the media stack MS and pick mechanism **300** until a predetermined sequence of output signal **484** transitions is detected depending on the media type determined for the media in media stack MS. Accordingly, in the examples illustrated in FIGS. **14**A-**141** where there are three light blocking regions **382-1**-**382-3** and two light passing regions **384-1**, **384-2** interposed between them, first light blocking region **382-1** is first to block the optical path, and, thus used to provide the lowest pick height for pick mechanism **300**, and then increasing pick heights are provided for by second light blocking region **382-2** and third light blocking region **382-3**. In FIG. **15**, the first LOW state region LOW-1 between the first transition **484-1** and second transition **484-2** corresponds to a condition in which first light blocking region **382-1** is positioned in the optical path and height of pick mechanism **300** is within a first pick height zone, the second LOW state region LOW-2 between the third transition **484-3** and fourth transition **484-4** corresponds to a condition in which second light blocking region **382-2** is positioned in the optical path and height of pick mechanism **300** is within a second pick height zone different from (or higher than) the first pick height zone provided for by the first light blocking region **382-1**, and the third LOW state region LOW-**3** after the fifth transition **484-5** corresponds to a condition in which third light blocking region **382-3** is positioned in the optical path and height of pick mechanism **300** is within a third pick height zone different from (or higher than) the second pick height zone provided for by the second light blocking region **382-2**.

In another example embodiment, locations at which light passing regions **384-1**, **384-2** unblock the optical path of index sensor **480** may be used to adjust pick mechanism **300** to other pick heights for feeding other types of media sheets. In the example illustrated in FIGS. **14**A-**141**, first light passing region **384-1** is used to adjust pick mechanism **300** to a pick height between the two pick heights provided for by first light blocking region **382-1** and second light blocking region **382-2**, and second light passing region **384-2** is used to adjust pick mechanism **300** to a pick height between the two pick heights provided for by second light blocking region **382-2** and third light blocking region **382-3**. In FIG. **15**, the first HIGH state region HIGH-**1** between the second transition **484-2** and third transition **484-3** corresponds to a condition in which first light passing region **384-1** is positioned in the optical path and height of pick mechanism **300** is within a pick height zone different from (or between) the pick height zones provided for by the first and second light blocking regions **382-1**, **382-2**, and the second HIGH state region HIGH-**2** between the fourth transition **484-4** and the fifth transition **484-5** corresponds to a condition in which second light passing region **384-2** is positioned in the optical path and height of pick mechanism **300** is within a pick height zone different from (or between) the pick height zones provided for by the second and third light blocking regions **382-2**, **382-3**.

Different media properties and characteristics may be considered in determining a desired pick location at which pick mechanism **300** is adjusted before media is fed. The angle at which pick mechanism **300** extends from drive shaft **426** and its pick height at that angle typically provides a corresponding normal force or pressure applied by pick mechanism **300** on the topmost media sheet M of the media stack MS, and that normal force or pressure exerted by pick mechanism **300** on the media sheet M may cause different effects on the behavior of the media sheet M during feeding depending on media sheet type. For example, when compressible media, such as envelopes or labels with RFID tags, or stiffer media, such as cardstocks, are fed at a particular pick height, their behavior may differ as compared to the situation when a normal media sheet, such as copy paper or bond paper, is picked at that particular pick height. For example, compressible media, such as envelopes or labels with RFID tags, tend to compress rather than buckle and separate when picked as pick mechanism **300** continues to rotate downward about the drive shaft **426**, and the normal force applied by the pick mechanism **300** to the media stack continues to increase. This compression will continue until the force required to compress the media exceeds the force required to buckle and feed the media at which point the media will buckle and feed. However, in some cases, by this point, the pick mechanism **300** will have rotated out of the desired pick zone. Furthermore, in some other cases, the compression presses the media down to pick against a vertical portion of the media dam **150** or a separator bracket thereon which can cause a failure to feed. There are also instances where the stiffness of heavy media tends to push out the tray as it hits the separator system during a pick feed operation. To aid in the picking of these media types, pick mechanism **300** may be adjusted to have higher elevated pick locations when picking these types of media. As an example, normal media may be picked at a pick height corresponding to a location at which first light blocking region **382-1** blocks the optical path of index sensor **480**, envelopes may be picked at a pick height corresponding to a location at which second light blocking region **382-2** blocks the optical path of index sensor **480**, and cardstocks may be picked at a pick height corresponding to a location at which third light blocking region **382-3** blocks the optical path of index sensor **480**. Other examples contemplate use of first and second light passing regions **384-1**, **384-2** to adjust pick mechanism **300** to higher elevated pick locations. Thus, by knowing the media type of the media stack MS, the height at which pick mechanism **300** picks and feeds media sheets M from the media stack MS can be adjusted to a desired height in correspondence to the media type by raising lift plate **172** until one of the light blocking regions **382-1**-**382-3** and light passing regions **384-1**, **384-2**, reaches the optical path of index sensor **480**. In this way, pick mechanism **300** can work reliably with different types of media sheets.

In one example embodiment, after the state of index sensor **480** changes (e.g., from unblocked to blocked or vice versa) after occurrence of a respective one of the first, second, third, fourth and fifth transitions **484-1**, **484-2**, **484-3**, **484-4** and **484-5**, depending on the media type determined, pick mechanism **300** is raised a predetermined distance upward without causing index sensor **480** to change its state before pick mechanism **300** begins to pick media sheets M from the media stack MS. Areas of the light blocking regions **382-1**-**382-3** that obstruct the optical path of index sensor **480** define the different pick height zones for pick mechanism **300**. Similarly, areas of the light passing regions **384** where the optical path of index sensor **480** is unobstructed may also define other pick height zones different from (or in between) the pick height zones defined by the areas of the light blocking regions **382**.

The point at which a transition occurs in the output signal **484** of index sensor **480** indicates that pick mechanism **300** has reached a lowest pick location within a given light blocking or light passing region. As pick mechanism **300** is raised, controller **3**, **53** determines whether pick mechanism **300** has reached a lowest pick location of the desired light blocking or light passing region based on the output signal **484**. After it is determined that pick mechanism **300** has reached a lowest pick location, motor **404** continues to rotate for a predetermined number of encoder pulses until lift plate **172** reaches a desired height in which pick mechanism **300** is raised to a predetermined level within the desired light blocking or light passing region. For example, with reference to FIG. **16**, when the media type determined is a media type that requires pick mechanism **300** to be raised within the area of first light blocking region **382-1**, lift plate **172** is raised upward until the first transition **484-1** occurs changing the state of index sensor from unblocked to blocked (FIG. **14**B), and thereafter, lift plate **172** is continued to be raised until pick mechanism **300** has moved a predetermined distance D within the first light blocking region **382-1**. Likewise, in FIG. **17** when the media type determined is one that requires pick mechanism **300** to be raised within a pick height zone defined by second light blocking region **382-2**, lift plate **172** is raised upward to lift pick mechanism **300** until the third transition **484-3** occurs changing the state of index sensor **480** from blocked to unblocked (FIG. **14**E), and thereafter, lift plate **172** is continued to be raised until pick mechanism **300** has moved a predetermined distance D within the second light blocking region **382-2**. In FIGS. **18-19** illustrating embodiments where light passing regions **384-1**, **384-2** are respectively used to adjust pick height, lift plate **172** is raised upward to lift pick mechanism **300** until pick mechanism **300** has moved a predetermined distance D within the first and second light passing region **384-1**, **384-2**, respectively, after occurrence of the second transition **484-1** or the fourth transition **484-4**, respectively. In one example embodiment, distance D may be greater than 1 mm, such as about 1.3 mm. In FIGS. **16-19** the region R below the traveled predetermined distance D within a light blocking region or a light passing region may be provided to compensate for system tolerances. In one example embodiment, this region R may be minimized to allow for smaller stack height changes between pick zones.

Once lift plate **172** reaches the desired height in which pick mechanism **300** is at a predetermined distance D within a desired light blocking or light passing region, pick mechanism **300** is then ready to feed media in the media process direction. As a media sheet M is fed, the height of the media stack MS decreases thereby lowering the position of pick mechanism **300**. Eventually, pick mechanism **300** lowers far enough for index flag **380** to change the state of index sensor **480** (e.g., from blocked to unblocked or vice versa), thereby signaling that another indexing move is required. Motor **404** once again rotates for the predetermined number of encoder pulses until lift plate **172** reaches the desired height in which pick mechanism **300** is raised again to the predetermined level D within the desired light blocking or light passing region. The indexing moves that occur as a result of the reduction in the height of the media stack MS due to media being fed are referred to as nominal raises or nominal index moves. As media continues to be fed, nominal index moves are repeated to ensure that the pick mechanism **300** stays within the desired light blocking or light passing region until all of the media sheets M in media input tray **100** needed for a given print job are fed to IFD **2**.

Each time media input tray **100** is removed from the housing **20**, drive transmission **401** disconnects from the second output **401**C causing the lift plate **172** to fall to bottom **108** of media input **100**. In the example embodiment shown, when media input tray **100** is removed, second clutched gear **416** and intermediary gear **418** in the side wall **104***a* are decoupled. As a result, each time media input tray **100** is reinserted into housing **20**, **60** lift plate **172** must be indexed from bottom **108** of media input tray **100** until pick mechanism **300** reaches a desired pick location. When IFD **2** is turned off, lift plate **172** remains in the same position unless media input tray **100** is removed. Therefore, when IFD **2** is powered back on, pick mechanism **300** continues to pick in the same pick zone as before the power-off cycle.

In the example embodiments where light passing regions **384-1**, **384-2** of flag **380** are used to adjust the pick height, an issue may arise when pick mechanism **300** is in one of the light passing regions **384-1**, **384-2** and IFD **2** is turned off. When IFD **2** is powered back on, the output signal of index sensor **480** may no longer be indicative of the position of pick mechanism **300**. First, removal of media input tray **100** while IFD **2** is turned off causes lift plate **172** to fall to the bottom **108**, and when IFD **2** is powered back on, flag **380** is returned to its starting position below index sensor **480** and index sensor is in the unblocked state. Second, if removable media input tray **100** is not removed while IFD **2** is turned off, lift plate **172** and pick mechanism **300** remain in the same position when IFD **2** is turned back on such that the light passing region **384-1**, **384-2**, as the case may be, remains positioned in the optical path and index sensor **480** is in the unblocked state. In order for controller **3**, **53** to determine whether the unblocked state of index sensor **480** is due to flag **380** being in a position below index sensor **480** caused by removal of media input tray **100** while IFD **2** is turned off, or due to being in a light passing region **384-1** or **384-2**, a lift plate sensor for sensing position of the lift plate **172** may be used. Referring back to FIG. **13**, media input tray **100** includes a lift plate sensor **250** for sensing whether or not lift plate **172** has fallen to the bottom **108**. In the example embodiment illustrated, lift plate **172** includes a flag **177** extending from the bottom **172***a* thereof and lift plate sensor **250** is an optical sensor having an optical path between a pair of opposed arms **252** that are spaced to allow flag **177** to be positioned therebetween and block the optical path when lift plate **172** falls to the bottom **108**. When IFD **2** is powered back on, also referred to as a power-on reset or POR, controller **3**, **53** determines whether lift plate **172** has fallen to the bottom **108** based on the status of lift plate sensor **250**. If lift plate sensor **250** is blocked by flag **177**, this indicates that media tray **100** was removed while IFD **2** was turned off and lift plate **172** has fallen to the bottom **108**. Accordingly, lift plate **172** is indexed from bottom **108** of media tray **100** until pick mechanism **300** reaches a desired pick location. If lift plate sensor **250** is unblocked by flag **177** when IFD **2** is turned on, this indicates that media tray **100** was not removed while IFD **2** was turned off, and lift plate **172** and pick mechanism **300** are retained in the same position as before the power-off cycle.

For the methods described herein, reference is made to FIGS. **20-22** illustrating a block diagram of a method M**1** for adjusting the pick height of pick mechanism **300** based on media type. Method M**1** begins at start block B**1**. At block B**5**, the lift plate **172**, media stack MS, pick mechanism **300** and flag **380** are brought to a predetermined initialized position in a selected media input tray **100**. Controller **3** or user-input provided to controller **3** may be used to select which media input tray **100** to use. In the selected media input tray **100**, a media stack MS having one or more media sheets M to be fed into IFD **2** is supported on lift plate **172** which is lifted by drive assembly **400** a predetermined number of indexed moves so that pick mechanism **300** is brought into contact with a topmost media sheet M of the media stack MS and flag **380** is initially positioned below index sensor **480** such that the output signal of index sensor **480** is in the first state. As used in the following descriptions, the first state corresponds to an unblocked state of index sensor **480** while the second state corresponds to a blocked state thereof. At block B**10**, controller **3**, **53** determines the type of media on lift plate **172** in the selected media input tray **100**. The media type may be indicated by a user, for example, at user interface **7** or at a peripheral device. Alternatives include those wherein the controller **3**, **53** determines the media type based on readings from media type sensor **230**.

At block B**15** a determination is made whether or not a power-on-reset (POR) has occurred. When it is determined that a POR has not occurred method M**1** proceeds to block B**25**. When it is determined that a POR has occurred, method M**1** proceeds to block B**20** where a determination is made whether or not the lift plate sensor **250** has been actuated by flag **177** on lift plate **172** due to the lift plate **172** dropping to the bottom **108** of media input tray **100** because media input tray **100** has been removed. When it has been determined that lift plate sensor **250** has been actuated, method M**1** loops back to block **5**, to reinitialize the system. When it has been determined that the lift plate sensor has not been actuated, method M**1** proceeds to block B**25**.

At block B**25**, a determination is made as to whether or not the determined media type is a first media type. When it is determined that the media type is a first media type, method

M1 proceeds to block B30 to raise lift plate **172** to raise the media stack and pick mechanism **300**. At block B35, a determination is made as to whether or not the first light blocking region **382-1** has actuated index sensor **480** by blocking the optical path thereof and causing the sensor output signal to have the first transition **484-1** changing from the first state to a second state. On determining that the first transition **484-1** has not occurred, method M1 loops back to block B30 to continue with the raising of lift plate **172**. When it is determined, at block B35, that the first transition **484-1** has occurred indicating that first light blocking region **382-1** has reached and blocked the optical path, then at block B40, the pick mechanism **300** has reached a first pick height. Method M1 then proceeds to block B45 to raise lift plate **172** and the media stack to raise pick mechanism **300** a predetermined distance D within the first light blocking region **382-1** and without causing first light blocking region **382-1** to move out of the optical path and the sensor output signal to change state. For example, lift plate continues to raise approximately 1.3 mm. At block B50, controller **3**, **53** controls motor **404** to drive pick mechanism **300** to feed a media sheet M of the first media type from the media stack MS.

Between each pick of the media sheet M, controller **3**, **53** determines whether or not the height of pick mechanism **300** has fallen below the first pick height at block B55, for example by determining whether first light blocking region **382-1** has fallen below and moved out of the optical path of index sensor **480** causing the output signal thereof to change from the second state to the first state due to the decrease in media stack height. On determining that pick mechanism **300** has not fallen below the first pick height, method M1 loops back to block B50 to proceed with the feeding of a next media sheet M. When it is determined, at block B55 that pick mechanism has fallen below the first pick height, method M1 loops back to block B45 to raise lift plate **172** and the media stack MS to raise pick mechanism **300** back to the predetermined distance D within the first light blocking region. The method M1 continues until all of the media sheets of the designated media type for a given print job have been printed.

When it is determined, at block B25, that that the determined media type is not a first media type, method M1 proceeds to block B60 to determine whether or not the determined media type is a second media type different from the first media type. When it is determined that the determined media type is the second media type, method M1 proceeds to block B65 to raise lift plate **172** to raise the media stack and pick mechanism **300**. At block B70, a determination is made as to whether or not the second light blocking region **382-1** has reached and blocked the optical path of index sensor **480** causing the sensor output signal to have the third transition **484-3** (change from first state to second state) following the second transition **484-2** (change from second state to first state) which in turn follows the first transition **484-1**. On determining that the second light blocking region has not reached the index sensor **480** (i.e., third transition **484-3** has not occurred), method M1 loops back to block B65 to continue raising the lift plate **172**. When it is determined, at block B70, that the second light blocking region has reached the index sensor **480** (i.e., third transition **484-3** has occurred), then at block B75, controller **3** recognizes that the pick mechanism **300** has reached a second pick height different from (or higher than) the first pick height. Method M1 then proceeds to block B80 to raise lift plate **172** and the media stack a predetermined distance D to raise pick mechanism **300** to a predetermined level within the second light blocking region **382-2** and without causing second light blocking region **382-2** to move out of the optical path and the sensor output signal to change from the second state to the first state. At block B85, controller **3**, **53** controls motor **404** to drive pick mechanism **300** to feed a media sheet M of the second media from the media stack MS in the selected media input tray **100**.

Between each pick, controller **3**, **53** determines whether or not the height of pick mechanism **300** has fallen below the second pick height at block B90, for example by determining whether second light blocking region **382-2** has fallen below and moved out of the optical path of index sensor **480** and the first light passing region **384-1** has reentered the optical path of index sensor **480** causing the output signal thereof to change from the second state to the first state due to the decrease in media stack height. On determining that pick mechanism **300** has not fallen below the second pick height, method M1 loops back to block B80 to proceed with the feeding of the next media sheet. When it is determined, at block B90, that pick mechanism **300** has fallen below the second pick height, method M1 loops back to block B80 to raise lift plate **172** and the media stack the predetermined distance D to raise pick mechanism **300** back to the predetermined level within the second light blocking region. Again, the method M1 continues until all of the media sheets of the designated media type for a given print job have been printed.

It should be noted that blocks B45 and B80 do not need to be performed when feeding the media sheet.

As discussed above, other example embodiments contemplate use of light passing regions **384-1**, **384-2** to adjust the height of pick mechanism **300** based on media type. In one example embodiment, when it is determined, at block B60, that that the determined media type is not a second media type, then the determined media type is a third media type different from the second media type. Method M1 then proceeds to block B95 to raise lift plate **172** to raise the media stack and pick mechanism **300**. At block B100, a determination is made as to whether or not the first light passing region **384-1** has reached and unblocked the optical path of index sensor **480** causing the sensor output signal to have the second transition **484-2** (change from second state to first state) following the first transition **484-1**. On determining that the second transition **484-2** has not occurred, method M1 loops back to block B95 to continue with the raising of lift plate **172**. When it is determined, at block B100, that the second transition **484-2** has occurred indicating that first light passing region **384-2** has reached and unblocked the optical path, it is recognized, at block B105, that the pick mechanism **300** has reached a third pick height between the first and second pick heights. Method M1 then proceeds to block B110 to raise lift plate **172** and the media stack a predetermined distance D to raise pick mechanism **300** to a predetermined level within the first light passing region **384-1** and without causing first light passing region **384-1** to move out of the optical path and the sensor output signal to change from the first state to the second state. At block B115, controller **3**, **53** controls motor **404** to drive pick mechanism **300** to feed a media sheet of the third media type from the media stack.

Between each pick, controller **3**, **53** determines whether or not the height of pick mechanism **300** has fallen below the third pick height at block B120, for example by determining whether first light passing region **384-1** has fallen below and moved out of the optical path of index sensor **480** causing the output signal thereof to change from the first state to the second state due to the decrease in media stack height. On determining that pick mechanism **300** has not fallen below the third pick height, method M1 loops back to block B115 to proceed with the feeding of the next media sheet M of the third media type. When it is determined, at block B120, that pick mechanism **300** has fallen below the third pick height, method M**1** loops back to block B**110** to raise lift plate **172** and the media stack the predetermined distance D to raise pick mechanism **300** back to the predetermined level within the third pick zone.

Although the example method M**1** has been described with three different pick heights at which pick mechanism **300** can be raised depending on media type, it is understood that pick mechanism **300** may be raised to any number of different pick heights by providing additional light blocking regions and light passing regions in flag **380**. For example, after is it determined at block B**60** that the media type is not a second media type but rather another media type, method M**1** may, in the alternative, proceed to block B**200** to raise lift plate **172** to raise the media stack and pick mechanism **300**. At block B**205**, a determination is made as to whether or not a third light blocking region **382-3** has reached and blocked the optical path of index sensor **480** causing the index sensor output signal to change from first state to the second state following the fifth transition **484-5**. On determining that the fifth transition **484-5** has not occurred, method M**1** loops back to block B**200** to continue with the raising of lift plate **172**. When it is determined, at block B**205**, that the third light blocking region **384-3** has been reached and blocked the optical path (i.e., the fifth transition **484-5** has occurred), it is recognized, at block B**210**, that the pick mechanism **300** has reached a fourth pick height greater than the first, second and third pick heights. Method M**1** then proceeds to block B**215** to raise lift plate **172** and the media stack a predetermined distance D to raise pick mechanism **300** to a predetermined level within the third light blocking region **384-3** and without causing the third light blocking region **382-3** to move out of the optical path and the sensor output signal **484** to change from the second state to the first state. At block B**220**, controller **3**, **53** controls motor **404** to drive pick mechanism **300** to feed a media sheet of the another media type from the media stack.

Between each pick, controller **3**, **53** determines whether or not the height of pick mechanism **300** has fallen below the fourth pick height at block B**225**, for example by determining whether the third light blocking region **384-3** has fallen below and moved out of the optical path of index sensor **480** causing the output signal **484** thereof to change from the second state to the first state due to the decrease in media stack height. On determining that pick mechanism **300** has not fallen below the fourth pick height, method M**1** loops back to block B**220** to proceed with the feeding of the next media sheet M of the another media type. When it is determined, at block B**225**, that pick mechanism **300** has fallen below the fourth pick height, method M**1** loops back to block B**215** to raise lift plate **172** and the media stack the predetermined distance D to raise pick mechanism **300** back to the predetermined level within the third pick zone.

Again blocks B**110**, B**215** need not be performed. Further, the process followed in blocks B**100**-B**120** for the first light passing region **484-1** to establish the third pick height may be followed as applied to the second light passing region **484-2** to provide a fifth pick height that is less than the fourth pick height and greater than the second pick height.

As discussed above, lift plate **172** is raised in indexed moves. Motor **404** raises lift plate **172** until one of the light blocking regions **382-1-382-3** and/or light passing regions **384-1**, **384-2** of index flag **380** of pick mechanism **300** changes the state of index sensor **480** and its output signal **484**, depending on media type. This signals that pick mechanism **300** has reached a lowest pick location of with the desired light blocking or light passing region corresponding to the media type determined. Lift plate **172** continues to be raised a predetermined distance D above the lowest pick point to raise pick mechanism **300** within a predetermined level within the desired light blocking or light passing region. As media sheets M are fed from media stack MS, pick mechanism **300** moves downward to a point just beneath the lowest pick point where the flag **380** changes the state of index sensor **480** as the corresponding light blocking/passing region of flag **380** falls below the optical path. This signals controller **3**, **53** to again index lift plate **172** upward to the predetermined distance D above the lowest pick point. For the example 1.3 mm index move previously described, the rotation movement of pick mechanism **300** is in an essentially linear motion, meaning that there is only a minute variance in the pick location of the topmost sheet. Lift plate **172** is raised periodically in an indexed move each time a light blocking region or light passing region of index flag **380** drops below index sensor **480**.

It should also be noted that the predetermined distance D that the lift plate is raised within a given light blocking or light passing region can be the same as or can be different from the predetermined distance used in another of the light blocking or light passing regions.

The foregoing description of several methods and an embodiment of the present disclosure have been presented for purposes of illustration. It is not intended to be exhaustive or to limit the present disclosure to the precise steps and/or forms disclosed, and obviously many modifications and variations are possible in light of the above description. It is intended that the scope of the present disclosure be defined by the claims appended hereto.

What is claimed is:

1. A media feeding system for an image forming device (IFD), the media feeding system comprising:

an input media tray having a bottom with a raisable lift plate for holding a media stack having at least one media sheet;

a pick mechanism rotatably coupled to a drive assembly for feeding a topmost media sheet of the media stack, the pick mechanism having a flag having a first and a second light blocking region, and a first light passing region therebetween;

an optical sensor mounted adjacent the input media tray, the optical sensor including an emitter and a photo-receiver spaced to allow the flag to pass therebetween and providing an output signal that changes between a first state and a second state as the flag passes between the emitter and the photo-receiver, the output signal representative of a position of the pick mechanism that changes as the height of the stack changes;

a lift mechanism operably coupled to the lift plate for raising the lift plate;

a lift plate sensor that is actuated when the lift plate is positioned on the bottom;

and,

a controller operably coupled to the optical sensor, the lift plate sensor, the drive assembly and the lift mechanism, the controller configured to:

control the lift mechanism to initialize the lift plate to a height in which the flag is positioned below the optical sensor and the output signal of the optical sensor is in the first state;

determine a media type for the media stack on the lift plate;

when the media type determined is a first media type, control the lift mechanism to raise the lift plate to raise the media stack and the pick mechanism until the first light blocking region is positioned between the emitter and the photo-receiver changing the output signal from the first state to the second state indicating that the pick mechanism has reached a first pick height;

when the media type determined is a second media type, control the lift mechanism to raise the lift plate to raise the media stack and the pick mechanism until the second light blocking region is positioned between the emitter and the photo-receiver changing the output signal from the first state to the second state back to the first state and then back to the second state indicating that the pick mechanism has reached a second pick height different from the first pick height; and,

feed one of the first media type and the second media type and determine after a power on reset whether or not the lift plate sensor is actuated, and, when it is determined that the lift plate sensor has not been actuated, continue to feed the one of the first media type media sheet and the second media type media sheet.

2. The media feeding system of claim **1**, wherein the first light passing region is defined by a slot formed between the first and second light blocking regions.

3. The media feeding system of claim **1**, wherein the first light passing region comprises a substantially transparent section of the flag between the first and second light blocking regions.

4. The media feeding system of claim **1**, wherein when the media type determined is a third media type, the controller is configured to control the lift mechanism to raise the lift plate to raise the media stack and the pick mechanism until the first light passing region is positioned between the emitter and the photo-receiver changing the output signal from the first state to the second state and then back to the first state indicating that the pick mechanism has a reached a third pick height between the first and second pick heights.

5. The media feeding system of claim **1**, wherein the flag further includes a second light passing region following the second light blocking region, and a third light blocking region following the second light passing region, the controller further configured to:

when the media type determined is another media type different from the first and second media types, control the lift mechanism to raise the lift plate to raise the media stack and the pick mechanism until the third light blocking region is positioned between the emitter and the photo-receiver changing the output signal from the first state to the second state back to the first state then back to the second state then back to the first state and then back to the second state indicating that the pick mechanism has reached another pick height different from the first and second pick heights.

6. The media feeding device of claim **1**, wherein the controller is further configured to:

when it is determined that the lift plate sensor has been actuated after a power on reset:

raise the lift plate and media stack to move the pick mechanism to reposition the flag below the index sensor with the output signal of the index sensor being in a first state; and,

redetermine the media type for the media stack.

7. In an image forming device (IFD) having a media input tray having a bottom with a raisable lift plate mounted thereon, a drive mechanism for raising the lift plate from the bottom, a flag-actuated index sensor mounted a predetermined height above the bottom, a lift plate sensor that is actuated when the lift plate is positioned on the bottom, a pick mechanism having a flag thereon, and a controller in operable communication with the drive mechanism, the index sensor, the lift plate sensor, and the pick mechanism, a method for adjusting a pick height of the pick mechanism comprising:

supporting on the lift plate a media stack having one or more media sheets to be fed into the IFD with the pick mechanism being in contact with a topmost media sheet of the media stack and the flag being initially positioned below the index sensor with an output signal of the index sensor being in a first state;

determining a media type for the media stack;

when the media type determined is a first media type:

raising the lift plate to raise the media stack and the pick mechanism until the index sensor is actuated by the flag causing the output signal to have a first transition from the first state to a second state, the first transition indicating that the pick mechanism has a reached a first pick height; and,

feeding one or more media sheets of the first media type using the pick mechanism;

and,

when the media type determined is a second media type:

raising the lift plate to raise the media stack and the pick mechanism until the output signal of the index sensor has the first transition followed by a second transition followed by a third transition, the second transition being from the second state to the first state, and the third transition being from the first state to the second state, the third transition indicating that the pick mechanism has reached a second pick height different from the first pick height; and,

feeding one or more media sheets of the second media type using the pick mechanism; and,

when feeding one of the first media type and the second media type, determining after a power on reset whether or not the lift plate sensor is actuated, and, when it is determined that the lift plate sensor has not been actuated, continuing to feed one of the first media type media sheet and the second media type media sheet,

wherein a first and a second light blocking region separated by a light passing region therebetween in the flag causing the first, second and third transitions of the output signal between the first and second states as the flag moves through the index sensor.

8. The method of claim **7**, further comprising:

when the media type determined is the first media type and after the occurrence of the first transition, raising the lift plate to raise the media stack and the pick mechanism a predetermined distance without causing the index sensor output signal to change from the second state to the first state, then after the pick mechanism is raised the predetermined distance and as the one or more media sheets from the media stack is fed by the pick mechanism, determining, whether or not the height of the pick mechanism has fallen below the first pick height based on whether or not the index sensor output signal has changed state, and, upon determining that the height of the pick mechanism has fallen below the first pick height, raising the lift plate to raise a remainder of media stack and the pick mechanism the predetermined distance;

and,

when the media type determined is the second media type and after the occurrence of the third transition, raising the lift plate to raise the media stack and the pick mechanism a predetermined distance without causing the index sensor output signal to change from the second state to the first state, then after the pick mechanism is raised the predetermined distance and as the one or more media sheets from the media stack is fed by the pick mechanism, determining, whether or not the height of the pick mechanism has fallen below the second pick height based on whether or not the index sensor output signal has changed state, and, upon determining that the height of the pick mechanism has fallen below the second pick height, raising the lift plate to raise a remainder of media stack and the pick mechanism the predetermined distance.

9. The method of claim **7**, further comprising when the media type determined is a third media type:

raising the lift plate to raise the media stack and the pick mechanism until the output signal of the index sensor has the first and the second transitions, the second transition indicating that the pick mechanism has a reached a third pick height between the first and second pick heights; and,

feeding one or more media sheets of the third media type using the pick mechanism.

10. The method of claim **9**, further comprising, after the occurrence of the second transition, raising the lift plate to raise the media stack and the pick mechanism a predetermined distance without causing the sensor output signal to change from the second state to the first state.

11. The method of claim **7**, wherein the method further comprises:

when it is determined that the lift plate sensor has been actuated:

raising the lift plate and media stack to move the pick mechanism to reposition the flag below the index sensor with the output signal of the index sensor being in a first state; and,

redetermining the media type for the media stack.

12. The method of claim **7**, further comprising:

when the media type determined is another media type different from the first and second media types:

raising the lift plate to raise the media stack and the pick mechanism until the output signal of the index sensor has the first transition followed by the second transition followed by the third transition followed by a fourth transition followed by a fifth transition, the fourth transition being from the second state to the first state, and the fifth transition being form the first state to the second state, the fifth transition indicating that the pick mechanism has reached another pick height greater than the first and second pick heights; and,

feeding one or more media sheets of the another media type using the pick mechanism,

wherein a third blocking region is separated from the second light blocking region by a second light passing region therebetween in the flag causing the first through fifth transitions of the output signal as the flag moves through the index sensor.

13. The method of claim **12**, further comprising, after the occurrence of the fifth transition, raising the lift plate to raise the media stack and the pick mechanism a predetermined distance without causing the index sensor output signal to change from the second state to the first state.

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